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Startup-Sequence

I'd like to first address a letter that I have received since the last issue. The first is from Raymond Zarling and is in regards to the article "Trading Commodities in Workbench 2.0," *AC's TECH Volume 3, Number 2*. He writes:

> The article "Trading Commodities in Workbench 2.0" was very interesting. It offered a focused way for me to learn more about writing commodities, which is one of those things I had been meaning to get around to for some time. I liked the writing style, too, which was helpful in explaining what was happening without becoming condescending.
>
> But the code, and hence the exposition, contained a bug. It took me some time to track it down, and it had meanwhile become embedded in another commodity I wrote myself modelled on what I had learned from this article. Lest other of your readers similarly repeat this mistake, I thought I would write in the hope you could publish a correction.
>
> The bug manifests itself if the user specifies a `CX_POPKEY` tooltype for the commodity. The code searches the tooltypes for this, and assigns the resulting string to a character pointer `x`, near the middle of function `openup()`. Then `ArgArrayDone()` is called, and that is a mistake, because the string to which `x` points is freed by that action, so the popkey string could be overwritten by the time it is used in the `Hotkey()` call. As a result, about half of the time when `MMB_CX` started in my startup-sequence (while there were plenty of other commodities starting up at the same time) the installation would fail with a "broker error".
>
> According to Commodore's autodocs for `ArgArrayDone()`, in `cx_lib.doc`:
>
> ```
> void ArgArrayDone (void)
> ```
>
> This function frees memory and does cleanup required by ArgArrayInit(). Don't call this until you are done using the tooltypes argument strings.
>
> One way of fixing the problem would be to copy the string x to some memory owned by MMB_CX before calling ArgArrayDone(). When I made that change and recompiled, the random errors I had been getting when using MMB_CX in my WBstartup ceased.
>
> Thank you for publishing an otherwise excellent article.
>
> Sincerely,
> Raymond L. Zarling

I would like to thank Mr. Zarling for bringing the bug to our attention and also thank him for offering a solution.

Disabled Users

While at the WOCA Toronto, I was approached by an Amiga user wanting to know if I knew of any good public-domain programs for the handicapped. This gentleman was confined to a wheelchair. Specifically, he was looking for a program that would allow him to use his Amiga to control electrical appliances in his house and anything else that might make his life easier. I directed him to *AC's GUIDE* and its complete list of Fred Fish software. On looking into the guide sometime later, I realized that there just is not a great deal of software available for handicapped Amiga users. The same holds true for the other major platforms. This is primarily because computer software programs designed for the physically and developmentally impaired are usually highly specialized and directed to the needs of an individual and not a group of users.

But does the Amiga have the potential to reach out to this special group of users? Given the power and flexibility of the platform, combined with the wide range of development packages available, the answer should be yes.

Many handicapped persons work with computers regularly. I have a friend, Julie, who is autistic. Julie has used computers at school and at home. She has a Nintendo Entertainment System™ that she has mastered and can play Super Mario Brothers™ better than Tommy played pinball. Julie has used my A600 on occasion. She is comfortable with using a mouse and is able to navigate around Workbench with no more trouble than the average user. But once she's on the computer, what will she do with it? Well, she enjoyed *DeluxePaint IV* and had a ball with *Pro Write*'s speak function. But aside from playing games, that was it.

Julie, as well as other disabled persons, can greatly benefit from the use of computers. We need more commercial and public domain software geared to the handicapped. There are specific areas where Amiga software could be beneficial, but development should not be limited to those areas. Business, productivity, entertainment, all categories should be included, not just educational and developmental.

The Challenge

AC's TECH is sponsoring a development contest. Basically, you have to develop an Amiga application geared toward disabled users. You may use any development system you wish and you may address a specific disability or present a program for a general handicapped audience. This will require some work. The time you spend on the application, both in research and development, will be time well spent. You will be doing a world of good for the community of disabled users.

AC's TECH will award prizes for the best application and two runners-up. The entry deadline is October 22, 1993. Your entry should be either a fully functional program or a working demo of the program. You must provide documentation with the program. Contest winners will be announced in the 4.1 issue of *AC's TECH*. We have put together a complete set of contest rules and entry information. We have also assembled a list of guidelines to follow and suggestions for possible development. It costs nothing to enter the contest and we are hoping for a large turnout. If you like to write code and develop applications, this is a good project to turn your talents and time toward.

Jeff Gamble
Editor

For the Contest Information Pack call or write *AC's TECH* at:

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OLÉ!

An Arcade Game Programmed in AMOS BASIC

by Thomas J. Eshelman

This article is intended to help the reader more fully appreciate an amazing language dedicated exclusively to the Amiga computer. A close examination of the accompanying code will reveal AMOS's simplicity as well as its power. We will carefully dissect a generic Amiga arcade game written in AMOS. AMOS is not dedicated to games programming, rumors to the contrary notwithstanding. However, because of its extremely high horsepower in the realms of sights and sounds, it is a natural preference for anyone thinking about programming games. Similarly, it can easily toss off those exercises commonly referred to as "Eurodemos." We will pay special attention to a few of the more important and powerful components of the language sometimes ignored in other discussions. After realizing just how little code has been written to realize a fairly complete gameimmersed as it is in copious comments, I hope that you will conclude it is worth your while to invest in AMOS. A compiled version of *OLÉ* is available for those of you without an AMOS interpreter.

What is AMOS?

AMOS is a superset of the BASIC programming language. Several hundred instructions, tailored especially to engage the special hardware of the Amiga computer, are appended to a garden variety BASIC. This is done in a fashion friendly to multi-tasking and without fear of invoking the dreaded Guru. The terms "AMOS" and "BASIC" may be and are used interchangeably.

Along with this BASIC interpreter comes a host of accessory programs, including a Sprite and Bob Designer/Editor, an AMAL Language Editor, a background editor called "TAME," an unusually powerful Menu Editor (like animated MenuItems!) and other programs that convert IFF, SMUS, Tracker, etc., files into formats directly useable by the interpreter. All these powerful utilities are themselves written in BASIC! A BASIC compiler and a 3-D object generator-animator are also available but at extra cost. One wonders what might have transpired had the Amiga been bundled with programs such as Power Windows™, AMOS and the ARP library at its debut in 1985.

OLÉ—The Game

OLÉ is a version of John Gilmore's clever PD game titled, *Fast Amigo*. The player moves the matador across each of four decks, picking up prizes as he climbs ladders leading to the next higher decks. All the while he must jump over charging bulls to avoid being gored. Appropriate sound effects are rendered. After the four decks are conquered, the user advances to the next skill level. With each of the nine skill levels, the matador becomes more tired, and hence slower. The bulls, however, run faster as they get madder, making them more difficult to avoid.

The original game was a bit fast for many mere mortals, even when run on a 68000 Amiga, unless you happened to be part mongoose. On an accelerated machine, it nearly defied visiblity. We want to illustrate AMOS, however, not reinvent the wheel. Fast Amigo exhibited a great sense of humor while it kept the plot simple. OLÉ will slow down the action not because of its BASIC origins, but rather by making the vertical blanking interval serve as an internal timer. Let's start by examining a less familiar but important feature of AMOS.

Memory Banks

The term "memory bank" has quite an exotic "ring" to it, but the concept is actually very simple. Memory banks are merely areas of memory which are automatically incorporated into the main file at such time as the file is saved to disk. Most of the time, banks are created automatically by BASIC, totally tranparently to the user. However, means are provided for the more advanced programmer to create and access them as required for some special program application. If I paint some Bobs in the Sprite Editor and save them to disk, they will be saved as an ".abk" file by default. When I load this ".abk" file using an instruction written into my BASIC program, memory bank number "1" will be created, and the image data will load there.

The purpose of memory banks is to hold data, such as images, music, and sound samples. AMAL programs are the exception (more on them later). It is logical enough to provide separate storage areas for the many categories of audio/visual data when you expect to commonly deal with them in large quantities. Thus, the BASIC interpreter is spared from having to gather it together from bits and

pieces scattered throughout memory. To get a quick feel for the subject, let's look at some memory banks in action.

Table 1 reveals 8 lines of code the programmer may choose to run but once, as long as he doesn't mind working with a large file. If he chooses to save the file after he runs it, these lines may thereafter be deleted! The first two lines each allocate a screen and load an IFF file, created for example from DeluxePaint™, from the disk into it. The next four lines are more directly on point. They automatically allocate and load memory banks with .abk (amosbank) files, the particular ID numbers of the banks being supplied as defaults by BASIC. You can't get much simpler than this!

Note that we create ".abk" files whenever we generate output from any of the various accessory or format-conversion programs, such as the Sprite Editor or the Sample_Bank_Maker.

Finally, we take those IFF screens and compress them into memory banks, this time employing the user's choice of bank ID numbers, with the "Spack" (screen pack) command. Spack allocates a memory bank of sufficient size to contain the compacted IFF file, compacts it and copies it therein. The purpose behind compacting the files is to save disk space, of course. The fruits of these operations are not realized, therefore, until we "save" the program. On that occasion, the screens will be saved to disk in a compacted form.

You should also be aware that there are a total of 15 of these memory banks available. The first five should be used by the programmer only in a pinch, since BASIC will also use them by default for specific data types. It is legal to append to other data within a bank, but why ask for confusion as to "what is where" until after all 15 have been used? Here banks 6 and 7 were chosen because banks 1, 3, 4, and 5 are "spoken for." Screens 0 and 2 are compressed, and shoehorned into the banks with only these two lines of code!

To make all this data an integral part of the program, we simply run BASIC and then resave the file! A 9000 byte file may "blossom" suddenly to one of 200,000 bytes, especially where a number of sound samples exist in a bank. Sound sample files are large by their very nature. Of course, we can subsequently delete the lines of code in Table 1 since we need never load these files again, unless we choose to modify them. Nor must these files be carried separately elsewhere on the disk along with your BASIC file. All the code, and all the data are now one "chunk," as it were.

We can then replace the Table 1 code with that in Table 2, if desired. When the disk file is loaded, AMOS automatically remembers, creates, and loads the same banks that were previously used to save the data! As far as the IFF pictures are concerned, the Unpack commands cause the banks containing them to be decompressed, screens to be allocated for them, and the pictures then copied from the banks into the screens. The banks may thereafter be erased if desired. This would free their memory for other uses.

The bottom line is that the choice is yours whether to carry around a number of small files, or to weld them into one large file. The latter includes the infamous memory banks as integral parts. For development work, I find it convenient to work with the large file, but I never delete the "Load" commands. Thus, any changes I make to an ".abk" file will be reflected in the dominant file without my having to remember to resave it separately. If you program on an unaccelerated machine, or worse, with no hard drive, it will certainly pay to work with the small, individual files. No time will then be wasted reloading or saving unaltered portions of your program.

What is AMAL?

The Amiga Animation Language. That's what! AMAL is a small sublanguage. In the AMOS system, the BASIC interpreter becomes and functions as a compiler of AMAL instructions! The sOLÉ purpose of AMAL is to move and animate any graphic elements, including Sprites, Bobs, screens, and rainbows.

The use of AMAL is optional, however. It contains only two instructions, irrelevant to OLÉ, that are not readily duplicated in BASIC. On the other hand, AMAL instructions have the advantage of being as fast as anything written in C or assembler, being as they are part of a compiled language. AMAL programs run asynchronously with their BASIC parent. They run at their own very high speed.

AMAL may be written using either the AMAL Editor, the output of which is automatically incorporated into memory bank no. 4 as an ".abk" file, or it may be written directly in the BASIC editor along and in line with other, common BASIC instructions.

AMAL consists of only 10 commands but these are *very* finicky as to their formatting. They consist of one (rarely two) uppercase letters only. Lowercase is not recognized. For example, to assign a value to a variable, there exists a command, the use of which is mandatory, called, "Let". This may just as well be written, "L", but it is error to write it as "LET", "LeT" or "lET".

Table 1

Load Iff "Title.pic",2	Allocate screens.
Load Iff "OLÉ.pic",0	Load IFF files into them.
Load OLÉSprites.abk	Create and load bank 1.
Load OLÉAmal.abk	" " " bank 4.
Load OLÉSamples.abk	" " " bank 5.
Load OLÉMusic.abk	" " " bank 3.
Spack 0 To 6	Create banks 6 and 7. Compress
Spack 2 To 7	screens 0 and 2 into them.

Table 2

Unpack 7 To 2	Allocate screen 2. Copy bank 7
Erase 7	into it. Then erase the bank.
Unpack 6 To 0	As above. Decompress bank 6
Erase 6	into screen 0, and erase bank.

Note: One never need refer to any ".abk" file as such.

By default, there are 16 AMAL programs or channels, each of which is driven or started up by its own hardware interrupt. Each channel animates and moves one graphics object. They all run independently of BASIC, and neither interferes with nor slows down the other. Since BASIC is not in the same league as any compiled language when it comes to speed, Francois Lionet, the father of AMOS, intends we do our animations in AMAL and our screen setups and other grunt work in BASIC. We may call an Amal program but once from BASIC, and not consider it again. The Amiga's interrupt system takes over.

There are two situations, however, where we will want to call AMAL programs out of the BASIC code itself, rather than letting them run by themselves via interrupts. First, we may want to simultaneously animate more than 16 Bobs or computed Sprites. The Amiga's hardware restricts us to using only 16 interrupts. BASIC can set up and run any number of channels, however. The default setting, as a matter of fact, is 64 Bobs or Sprites!!

Secondly, we can never do collision detection within an interrupt handler. The Amiga's Blitter hardware prohibits this. We still want to do collision detection, however, from within AMAL and not BASIC, since AMAL is always faster by several orders of magnitude, even when called from BASIC.

The AMOS system provides a workaround in the form of the "Synchro" command. With each call to Synchro, all the AMAL programs are launched asynchronously with the rest of the BASIC code. This gives us the best of both worlds. You arrange to call the Synchro command once before each vertical blanking interval (VBI). This is the route we will go in OLÉ, and this is the reason we broach the subject of AMAL this early.

Writing AMAL programs

Let us examine some AMAL code. When writing AMAL instructions, I humbly suggest you utilize the AMAL editor as opposed to writing them directly in BASIC. It is legal to do both, but the first scheme avoids the confusion offered by the interminably long columns of inline code characteristic of BASIC, and it saves having to repeatedly type the damnable 'A$=A$+""' line starter. Also, the AMAL Editor allows instant testing of just your AMAL channel, as long as you bother to load a few Bobs or Sprites into the "Environment Channel" for display purposes. AMAL also provides a debugger with which you can read, write, or follow AMAL variables. The down side of all these wondrous artifacts is that you must learn to use the AMAL Editor. Please turn your attention to Table 3.

Here is an AMAL program consisting of seven commands in four lines. However, it is enough to continuously gallop one of our bulls back and forth across the display. The same code appears in channels 2, 3, and 4, each controlling one bull. "Let" is our first AMAL command. Observe it appears in both legal formats mentioned above. 'X' is a "magic" variable that always contains the horizontal coordinate of whatever you are animating with this particular channel. It is a local variable with that name, "X", hardcoded. Each channel has its own "X". The value "15" is chosen since it starts the bull just inside the left edge of the screen. "Y", obviously, is the vertical coordinate and works just as described for "X". "A:" is a label. Note well the distinguishing colon character!

"Anim" is another of our 10 AMAL instructions. It will display image #4 (a standing bull) for nine ticks (50ths of a second), then image #5 (a stretched out bull) for 15 ticks. The value "0" directs it to cycle continuously. "Move" is yet another of the 10 AMAL commands. Here, we move right 290 pixels, down 0 pixels in "RA" time quantums. "RA" is one of 26 global AMAL variables (RA-RZ) that we may access from within BASIC as well as from within any other AMAL program! They work much like C globals in the latter language. By reducing the value in RA, we quicken the horizontal speed of the galloping bull. Increasing RA does the opposite.

The next Anim and Move commands are very similar. We exhibit mirror images (nothing to it thanks to the Sprite Editor) so our bull faces left, and run him left for 290 pixels. 'Jump A' does just as you would expect. It loops forever. 'Jump' could have been written merely as 'J'. The bull ordinarily won't stop galloping back and forth across the screen until we quit the program or turn off this AMAL channel

Table 3

```
' chan 1 to bob 1
' bottomost bull
'
Let X=15;          L Y=196;

A: Anim 0,(4,9)(5,15); Move 290,0,RA;

A 0,(2,9)(3,15); M -290,0,RA;

Jump A;
```

Table 4

```
'chan 8 to bob 8
'top prize

'assign a value from setprizes procedure in basic
 'to this channel's x

      Let X=RK;

'if collision legal, check for same.
'else pause and retest flag

      A: If RL=0  Jump B;  Pause;  Jump A;

'if a collision is detected, set anti-repeat flag

      B: If BC(8,0,0)  J C;  P;  J A;

      C: L RL=1;

'display appropriate prize image.
'increment score per current skill level

    L A=RC+19;  L R0=RC+1;  L RM=R0*10+RM;  L RP=1;  J A;
```

Table 5 ———

```
* chan 0 to bob 0
* the matador
'
' r0=loop counter, r2=climbing flag, r8=jumping flag
' ra=bull speed, rd=operations deck, rm=matador speed
' re, rf and rg=ladders centers
' rl=prize collision loop preventer
'
L R0=0; L R2=0; L R8=0;
'
* read the joystick.  synchronize to display.
* order = fire, left, right, up
'
A: Pause;
B: If J1&16 Jump F;
C: If J1&4 Jump G;
D: If J1&8 Jump H;
E: If J1&1 Jump I;
'
* lastly, check if a moving bull collided with
* a stationary matador
'
If BC(0,1,4)  J P;  J A;
'
* if not already jumping, set the 'i am jumping' flag,
' jump quickly, pause for a period whose length is
' relative to the bull speed, check for collisions with
' bulls while slowly descending
'
F: If R8=1  J A;  L R8=1;  L Y=Y-25;  F R0=1 T RQ  N R0;
    F R0=1 T 25  If BC(0,1,4) J P;  L Y=Y+1;  N R0;
      L R8=0;  J A;
'
 * return to reading joystick if move would cause clipping
'
G: If X >  8  J J;  J A;
H: If X < 312  J K;  J A;
'
 'test the 'i am climbing' flag, reset jumping flag,
'and  select proper ladder.
'
I: If R2=1 J A;  L R8=0;
    If RD=0 J L;  If RD=1 J M; If RD=2  J N;
'
* pick left or right image, reset flags,
* move matador using f to n loop.  helps render cpu
* speed irrelevant.  also check for collisions.
'
J: Let A=6;  L R2=0;  L R8=0;  F R0=1 T 2  L X=X-RN;
    If BC(0,1,4)  J P;  N R0;  J A;
'
K: Let A=8;  L R2=0;  L R8=0;  F R0=1 T 2  L X=X+RN;
   If BC(0,1,4)  J P;  N R0;  J A;
'
* determine the proximity of the matador's hot spot with
* pertinate ladder's.  then execute one of the following
' L: L R7=RE-X; J O; M: L R7=RF-X; J O; N: L R7=RG-X; J O;
'
* see if hot spots are within 6 pixels.  pick the frontal
* image.  climb 50 lines slowly.  this will remain
* constant regardless of cpu because of the vblanking
* implied in the for loop.  every second pixel of climb,
* check for collision with bull.  set climb flag.
* increment operations deck level number, reset the
* 'got prize' flag.
*
* heads up..heads up.. note how we assign bool expressions
* individually to r6 and r9, check both simultaneously in
* one 'if' test.  this saves one jump instruction, keeping
* within the 3 loop limit.
'
O: Let R6=R7>6;  Let R9=R7 < -6;  If R6|R9 J A;  Let A=7;
    For R0=1 To 25  Let Y=Y-2;  If BC(0,1,4) J P;  N R0;
   Let R2=1; Let RD=RD+1;  Let RL=0;  J A;
'
*  matador collided with a bull.  move him off screen.
*  set 'gored' flag.
'
P: F R0=1 T 15  L X=X-15;  L Y=Y-15;  N R0;
  L R2=0; L R6=0; L R8=0; L R9=0; L RO=1; J A;
'
' end AMAL
```

from within BASIC. In our situation, we could also stop the action simply by failing to recall "Synchro".

This is a good time to note a point which the otherwise extensive manual does not. Both the apostrophe character and the asterisk can be used to create a comment line when in the AMAL Editor. What is not mentioned, however, is that *no uppercase characters* may appear in the comment itself!

Let's study another AMAL channel. This one is dedicated to prize collection. There are four of these also: 5, 6, 7 and 8. The prizes only 'move' when skill levels are reset. However, we want to handle them within AMAL because AMAL presents a very convenient method for detecting collisions. When a collision is detected, we want instant substitution of a score image for the prize image. Table 4 is part of what is seen when the file, OLÉAmal.abk, is loaded into the AMAL Editor. In only five lines of code, a prize bob is fixed, collision with the matador bob is checked, its image swapped on the display if a collision were detected, and the score incremented in accordance with the current skill level!

"RK" is the horizontal coordinate assigned to Bob 8 in BASIC. You will see this is a randomly generated value. Unless we are currently colliding, we jump to label B. Else, we will wait for a vertical blanking

interval, and reloop back to label A. "If", is another AMAL command. Here we see that the *only action available if* an expression evaluates as *true* is to *jump*! This is an AMAL idiosyncracy that took me quite a while to become accustomed to.

"Pause," another AMAL command, performs the same function as WaitTOF() does in C. It synchronizes the execution of the program with the vertical blank interval, the same time quantum in any and all Amigas. At label B:, we call the AMAL Bob collision tester function, BC(), on this Bob, with the matador (channel 0). If none, pause and reloop. Else, set a flag to prevent a collision loop.

The 'A' on the last line is the third AMAL 'magic' variable. It refers to the image number for this Bob as it is found in the Sprite Bank, or bank #1. "RC" is a value we set in BASIC to represent the current "skill level." For example, if this line of code is reached, the "Bag of Gold" prize will suddenly become a large "10" on the display. If you were to load the file, "OLÉSprites.abk" into the Sprite Editor, you will observe each image as you punch in an image number. It follows that this is how you edit them.

"RM" is the score printed on title bar. The algorithm seen here increments the lowest level by 10 with each prize, and the highest level by 90. Note that in AMAL, all operations evaluate strictly left to right! Parenthesis are illegal! The "RP" variable is used only in channel 8 (the uppermost deck). When RP is set, it tells BASIC that the user has attained the top deck, so that BASIC will bump him to the next higher skill level.

Finally, let's examine the Amal channel dedicated to operating the matador figure in response to the joystick. Begin by giving your attention to the comments contained within the code in Table 5. This is now becoming self- evident to you, and much less external explanation is required.

Remarks Regarding The Matador Channel

In addition to the previously mentioned 26 global variables, "RA-RZ", that may be shared with BASIC and all other AMAL channels, this code illustrates the existence of 10 additional local AMAL variables that exist in and are private to each AMAL channel in use. These also bear hardcoded names: "R0-R9", and like the RA-RZ globals, may contain any 16-bit signed integer.

Thus far, we have already learned seven of the AMAL commands: Let, Move, Anim, Jump, If, Pause, and For.

Among important things to note are the 'For' loops. "For.. To.. Next" is abbreviated as F, T, and N. AMAL automatically does a WaitVbl, or Pause, with each iteration of an F T N loop! This causes not only remarkable smoothness to the animation, but helps render the CPU speed irrrelevant! The liberal use of WaitVbl or Pause instructions helps assure your program will run at approximately the same speed regardless of whether the user has a 7mc 68000 or a 33mc 68040 CPU. (Everyone learns this the hard way!)

It should be apparent that we could easily substitute "For" loops operating on an object's 'X' and 'Y' registers for the 'Move' command. Because of the automatic Pause done at the end of each iteration, the former scheme is usually superior. As a matter of fact, when OLÉ is run on an accelerated machine, the bulls' running speeds can be inconsistent. This happens to add a little 'zest' to the game play. For this reason, the 'Move' command has been left in there.

Back to our algorithm: When jumping at F:, we jump instantly 25 lines, but we 'float' at the top for the duration of "RQ" VBlanks. Then, we descend one line per iteration, checking for collisions all the while.

Important!

A reminder that while in AMAL, the 'If' statement brooks no 'Else'. Each test is a "soloist," *and success may result only in a* "Jump" *instruction*!

Pay close attention to the fact that the matador channel has its very own X, Y, and A variables which are hard coded by AMAL with horizontal and vertical coordinates, and the Sprite Bank image number, respectively. This provides enormous power with few lines of code!

A Bug!!

I have been able to document one bug in AMAL to date. Usually, there is a workaround. The programmer seems to be limited to three "Jump" instructions within some undocumented length of code. Failing to abide this renders an absurd error message. This explains the Mickey Mouse(tm) algorithm used at label O:. I had to figure a way to eliminate one of my Jump instructions, and it was done with the aid of a trick described in the AMOS manual.

```
O: Let R6=R7>6;  Let R9=R7 < -6;  If R6 | R9 J A;
```

"R7 > 6" must evaluate TRUE or FALSE. R6 is therefore assigned either -1 or 0. "R7 < -6" must evaluate in like manner, and R9 is assigned -1 or 0. Then, if *either* R6 OR R9 is *true*, the matador is not reasonably centered with the ladder, and we "Jump" back to the start of the program. Previously, I tried to code this with a pair of "If" statements, each of which required a "J A" putting me one over the "Mystic Trinity Finity."

Let's leave the subject of AMAL with a request that you take special note of just how few lines of actual code are required to do so much! The commands are indeed finicky, but there are very few of them for you to master. The results are well worth being 'deviled' a few evenings.

BASIC

Lastly, we reach the BASIC code itself. This is very simple, since the "brain work" is largely contained in the AMAL programs. Study the comments carefully. They are not in proper BASIC format, because I have used them in lieu of writing out notes in standard paragraph form. It is far easier to read explanations when immediately adjacent to the code under discussion.

Besides, it is not intended that you slavishly type this code into your AMOS Editor. AC's editor will make this complete file available to the reader in the best possible way. You may also expect to see a compiled version on Portal et al sometime in the future. Let's have a gander at Table 6.

That's about all there is to it! All these files, stripped of their comments, and despite the inefficiencies of my programming techniques, still total only 7626 code characters! Also, in case you were wondering: OLÉ's background music is a SoundTracker module borrowed from a Portal library and reformatted with the SoundTracker2_1.AMOS accessory. The command "Music 1" starts the playback and Music Off stops it.

The SampleBankMaker.AMOS accessory converted all the RAW digital samples (as playable by "Sound" from GRAMMA SOFT-WARE™) to the form required by the SAM PLAY command. The Sprite Editor allows easy conversion of IFF icons or brushes into

Sprites and Bobs should you prefer using a more potent paint program to the somewhat restricted editor. You will find that, thanks to the AMOS language and several of the many PD utility programs out there, your imagination is the only limit to what you can quickly produce on your Amiga. As far as hours of enjoyment are concerned, I can think of no greater value for so few of your dollars than AMOS. True, C will permit creating programs with faster searches, sorts, and associated grunt work, and a C compiler is another great "bang for the buck." But if visual and audio thrills are important to the task at hand, AMOS is the way to go. AMOS is also simple enough that you will be up and running in a very short time. As a bonus, you don't need an accelerated machine with multi-megabytes of memory to fully exploit it.

For you experimenter types out there, AMOS provides a number of ultra low level commands that permit direct access to the CPU registers out of BASIC! We will save them for another day!

Table Six

```
Table 6
——
'
'  OLE.AMOS by Thomas J. Eshelman  (TOMESH)
'
'      Reading, Pa.  October 1992
'
'         Design by John Gilmore
'
' Note:  To improve readability, the comments are not
'        BASIC legal.
'
Load Iff "Ole/Title.pic",2
Load Iff "Ole/Ole.pic",0
Load "Ole/OleSprites.abk"  ; Creates and loads bank 1.
Load "Ole/OleAmal.abk"     ; Ditto bank 4.
Load "Ole/OleSamples.abk"  ; Ditto bank 5.
Load "Ole/OleMusic.abk"    ; Ditto bank 3.
'
Screen 2            ; Makes this current and visible.
Music 1             ; Starts title music.
Auto View Off       ; Prevent further automatic display-
ing
'
Screen Open 1,320,200,16,Lowres  ; Allocates screen for
 Screen Copy 0 To 1              ; second background
pic.
'
Get Sprite Palette : Flash Off : Hide : Double Buffer
'
Screen 0     ; Makes this screen current
Fade 1       ; so we can quickly fade it to black.
Screen 1     ; Makes this current for future operations.
Synchro Off  ; Utilized to detect collisions via AMAL
'
Dim LAD(3)         ; For horizontal coords for 3 ladders
Dim PRIZE(4)       ; For horizontal coords for 4 prizes.
'
' All bobs to be assigned an AMAL channel must first be
' declared.  We don't care where they are drawn at this
' time.  Since Auto View is OFF, the draws are actually
' being done in the 'invisible' current screen 1.
'
' Bob 0 is the matador.
' Bobs 1,2,3,4 are the bulls;
'            from the bottom deck to top.
' Bobs 5,6,7,8 are the prizes,
'            from the bottom deck to top.
'            See Proc SETPRIZES
'
Bob 0,250,250,6
Bob 1,15,296,2 : Bob 2,304,246,2 : Bob 3,15,296,2
Bob 4,304,246,2 : Bob 5,250,250,10 : Bob 6,260,260,10
Bob 7,270,270,10 : Bob 8,280,280,10
'
' Bobs 9,10,11 are the ladders, bottom deck to top.
' See Proc SETLADDERS
' Bobs 12,13,14,15 are the Remaining Matadors icons.
' See Proc SETICONS
'
' Makes the mandatory AMAL channel assignments.
'
Channel 0 To Bob 0 : Channel 1 To Bob 1
Channel 2 To Bob 2 : Channel 3 To Bob 3
Channel 4 To Bob 4 : Channel 5 To Bob 5
Channel 6 To Bob 6 : Channel 7 To Bob 7
Channel 8 To Bob 8
'
' Purpose of global AMAL variables
' read or written from BASIC
'
' RA=BULL SPEED.  RC=Skill level (0-8).
' RD=Operations deck (0-3).  RE, RF, RG are ladder X's.
' RH, RI, RJ, RK are prize X's.  RL=Got prize flag.
' RM=Score.  RN=MATADOR SPEED.  RO=Gored flag.
' RP=4th Level done flag  RQ=Jumping delay time.
' RR=Score increase.
'
' Sprite Bank Image Nos. for prizes at each of 9 levels
' For information only.
'
' BAG=10 : BALLOON=11 : SHADES=12 : CONE=13 : CANNON=14
' BEER=15 : LOCO=16 : HOTDOG=17 : WHISKEY=18
'
' Sound File Sample Bank Numbers  -  Used!
'
BOING=1 : CROWD=2 : GLASS=3 : HIGH=4 : HORN=5
LAUGH=6 : OK=7 : PRIZE=8 : YELL=9
'
'
'  Following is the "main()" program!
'  The next instructions are given once and done when
'   the  game begins.
'
Ink 4,5        ; Writes blue over white text on screen
1.
Text 2,9,"Ole! Amos 1.0"
'
'   The AMAL code is thus assigned to the AMAL channels.
'
Amal 0,0 : Amal 5,5 : Amal 6,6 : Amal 7,7 : Amal 8,8
Amal On
'
Proc SETICONS      ; Puts little faces in the title bar
'                  ; of screen 1.
Volume 63          ; Loud sound samples.
'
   ; Resets AMAL register RD, current ladder X.
Amreg(Asc("D")-65)=0
   ; Resets AMAL reg. RL, the 'got prize' flag
```

```
Amreg(Asc("L")-65)=0
   ; Resets AMAL reg. RM, the scoreboard
Amreg(Asc("M")-65)=0
   ; Resets AMAL reg. RO, the 'gored' flag.
Amreg(Asc("O")-65)=0
   ; Resets AMAL reg. RR, the 'scored' flag.
Amreg(Asc("R")-65)=0
'
Text 220,9,"SCORE 0" ; Writes to 'invisible' screen 1!
'
A=5                          ; User gets 5 lives to
lose.
'
' Anim channels can be assigned only to currently-
existing
' bobs. Ergo, draw the bulls, prizes and man 'off
screen'
' to avoid premature displays. To be sure our bulls
' always restart from the edges of the display, we turn
' their AMAL channels OFF, restarting them at each 'gore'
' or new level. This means channel execution always
' starts over from the very first line of code where X is
' set at the display edges. The matador is handled the
' same way to avoid reading an incidently buffered
' 'collision' on resets.
'
' Simple scheme forces 20 secs of music.
Wait 1000
Music Off          ; Enough already!
'
Auto View On       ; Current screen now visible.
'
' This is the start of the main loop. For each of 9
skill
' levels, 0 to 8, we begin by turning off the Matador and
' Bulls AMAL programs. We put the current screen we had
' been drawing to, to the back, forcing screen 0, the
' blackened screen to the front. After making screen 0
' current, we print some blue over tan text on it, and
' flush it with the sprite color palette. In case you're
' wondering, this would make it visible. We fade it in
' over a period of 80 ticks. Next our voice tells the
' user it's OK to play. Keep in mind we're in BASIC now,
' not in AMAL.
'
For B=0 To 8
   Amal Off 0 : Amal Off 1 : Amal Off 2
   Amal Off 3 : Amal Off 4
   Screen To Back
   Screen 0
   Ink 4,1   ; Sets blue over tan when writing on screen
0
   Text 52,125,"Press Fire Button When Ready"
   Fade 5 To -1    ; Puts color into the display
(flushes)
   Wait 80
   Sam Play $3,OK
'
   Do             ; Wait for user to begin
     Wait Vbl     ; in a manner friendly to multi-
tasking.
     If Fire(1) Then Exit
   Loop
'
' We fade viewer's screen to black over 80 ticks. Turn
' display off while screen 1 is being drawn and until
' after we again flip it front. First, make it
' 'current' so that it receives the graphic commands.
' Flush it with color and delay 30 ticks for that
process
' to complete. Since we turned off some AMAL channels,
' we must reassign them before turning them back on.
' The scorekeeping routine in the AMAL prize channels
' needs to know what skill level the user is on for its
' scoring algorithm. This value is sent over to AMAL in
' register 'RC'.

   Fade 4 : Wait 80
   Auto View Off       ; From here, no visible changes.
   Screen 1
   Fade 2 To -1
   Wait 30
   Amal 0,0 : Amal 1,1 : Amal 2,2 : Amal 3,3 : Amal 4,4
   Amal On 0 : Amal On 1 : Amal On 2
   Amal On 3 : Amal On 4
  Amreg(Asc("C")-65)=B
'
' Develop a short, sweet, suitable algorithm to increase
' the bulls' speed as the skill levels increase (a lower
' travel time value in register 'RA'). I discovered
' quite by accident that you need add a pause at the top
' of the matador's leap in order that the bull can pass
' under him slowly. As the bull reaches a certain
speed,
' you must remove the pause lest the matador have the
' misfortune to meet him during his majestic descent if
' the bull does a quick turn around. This pause value
is
' kept in register 'RQ' as examining channel 0 AMAL code
' will reveal. You will experiment with these values to
' suit your reflexes. I am not particularly fast. 8-)
' In like manner, you want to slow down the horizontal
' speed of the matador as the levels increase so as to
' give the bull more chances to get him.
'
  SPEED=(120-(B*9))
  Amreg(Asc("A")-65)=SPEED ; Travel time 120-48
'                          ; in decrements of 9
   If SPEED>100
    Amreg(Asc("Q")-65)=SPEED/10
'
  Else Amreg(Asc("Q")-65)=1
   End If
'
  MANSPEED=(11-B)/2
   If MANSPEED<2
     MANSPEED=2
   End If
  Amreg(Asc("N")-65)=MANSPEED ; Man slows 5-2 thus:
'                             ; 5 5 4 4 3 3 2 2 2
'
' Call the functions that return random horizontal
' positions for the ladders and prizes, draw them onto
' the current screen (1), and transmit the returned
' positions to AMAL routines that use them via global
' registers. Call the function that draws the matador
in
' the center of the same screen. Then bring the current
' screen to the front, sending screen 0 to the back.
' Before we forget it, we make this screen 0 current
' momentarily, so we can quickly fade it to black for
' future flushing before the user's eyes. Finally, we
' again make screen 1 current, and render it visible.
'
```

```
  Proc SETLADDERS
  Proc SETPRIZES[B+10]
  Proc SETMATADOR
'
  Screen To Front
  Screen 0
  Fade 1
'
  Screen 1
  Auto View On
'
' The action begins. With each iteration, we first call
' each of the AMAL channels once, then mark time until
' the next screen blank. When this begins, we check the
' flag to be set by Channel 0 in the event the matador
is
' sent flying. If so, we play 3 sound samples while
' waiting long enough for each one to complete before
' moving on. We erase an icon, decrement a life, and
' falsely decrement a skill level. I say 'falsely',
' because it is reincremented with the "NEXT B" state-
ment
' to be encountered. The 'gored' flag, AMAL register,
' "RO", must be reset for further action.
'
   Do
    Synchro      ; Call all AMAL channels simulta-
neously
    Wait Vbl     ; Stop here, until screen blanks.
     '
    If Amreg(Asc("O")-65)=1   ; then matador was gored.
       Sam Play $F,BOING
       Wait 50
'
       Bob Off A+10
       Dec A : Dec B
      Amreg(Asc("O")-65)=0
       Sam Play $F,YELL
'
       If A<1              ; Then we have no more lives
          Exit
       End If
'
       Fade 10
       Wait 100
      Sam Play $F,GLASS
       Wait 100
       Exit
     End If
'
' If we are not gored, we should next test AMAL register
' RR to see if the user has garnered a prize, and make a
' noise and increase the printed score value if so. We
do
' this by saving the last score in RR. RM always has any
' new value set by an AMAL prize channel. We need only
do
' a fast and snappy "compare" to see if the matador
' grabbed a prize.
                          ; if new score > old score
   If Amreg(Asc("R")-65)<>Amreg(Asc("M")-65)
      Sam Play $F,PRIZE
     Text 220,9,"SCORE"+Str$(Amreg(Asc("M")-65))
'                         ; make old score = new
score
     Amreg(Asc("R")-65)=Amreg(Asc("M")-65)
     End If
'
' And lastly, we check on the status of AMAL register RP.
' This is set only by the AMAL channel belonging to the
' uppermost prize. If this has been captured by the
user,
' he has completed a level. Reset the flag, make joyful
' noises, and fade out the screen. (more code would be
' useful here)
'
    If Amreg(Asc("P")-65)=1    ; top deck's prize hit
       Amreg(Asc("P")-65)=0
       Sam Play $5,HORN
       Sam Play $A,CROWD
       Wait 50
       Fade 10
       Wait 200
       Exit
     End If
'
   Loop              ; Mates with 'Do'
'
   If A<1            ; If we are out of lives (icons)
     B=10            ; fool B into exceeding its
bounds,
   End If            ; thus dropping out of the loop.
'
' If, upon dropping out of the B loop we find the value
of
' B to have been 8, then the user must have successfully
' completed the game. Reward him with some sound ef-
fects,
' a slow fade out, and then quit the program with an END
' statement to avoid the loud guffaws that otherwise
ensue
' when leaving the program.

   If B=8
     Sam Play $F,HIGH
     Wait 50
     Sam Play $5,HORN
     Sam Play $A,CROWD
     Fade 15
     Wait 225
     End
   End If
Next B
'
' If we drop out the B loop for any reason other than
that
' B=8, it must be because "Slow Hands" ran out of matador
' lives. ie: he screwed up. Give him the raspberry
' before fading out and returning to the workbench.
'
Sam Play $A,LAUGH
Wait 50
Sam Play $F,LAUGH
Fade 15
Wait 225
'
End               ;Return to the WBench.
'
' In this procedure, we develop 3 random locations from
12
' to 308 at which to place the hot spots for the 3
ladders
' (keeping them entirely on the display). Their Y
' coordinates are fixed at 96, 146 and 196. The X
```

```
' coordinates are stored in the LAD array, and loaded
into
' the global registers RE, RF and RG for use by AMAL. We
' use a little trick to assign the lowest ladder first.
' We also make doubly certain that register RD is zero to
' begin with before it is used in the channel 0 routine.
'
Procedure SETLADDERS
  Shared LAD()
  B=196
  For A=0 To 2
    LAD(A)=Rnd(296)+12
    Amreg(A+4)=LAD(A)
    Bob A+9,LAD(A),B-(A*50),1
  Next A
 Amreg(Asc("D")-65)=0
End Proc
'
' We place one prize on each level at a random horizontal
' position similar to the ladder placement algorithm.
' Note this Procedure takes an argument that depends upon
' the skill level. The positions are kept in the PRIZE
' array and are fed into AMAL registers RH, RI, RJ and RK
' for use in the prize channels. We quit after making
' certain RL, the 'got prize' flag is reset.
'
Procedure SETPRIZES[LEVEL]
  Shared PRIZE()
  B=196
  For A=0 To 3
    PRIZE(A)=Rnd(296)+8
    Amreg(A+7)=PRIZE(A)
   Bob A+5,PRIZE(A),B-(A*50),LEVEL
  Next A
 Amreg(Asc("L")-65)=0
End Proc
'
' We use this Procedure to place four "face" icons on the
' title bar. We use four separate bobs for this to make
' our life easy when it comes to removing one whenever a
' matador is lost simply by calling the BOB OFF command.
'
Procedure SETICONS
  For A=0 To 3
    Bob A+12,(A*14)+120,2,9
  Next A
End Proc
'
' This Procedure is for completeness only. It does
' nothing but consistently respot the matador bob in the
' exact center of the bottom level when called.
'
Procedure SETMATADOR
  Bob 0,160,196,6
End
```

Listing One

```
* chan 0 to bob 0
* the matador
'
' r0=lp cntr, r2=climb flag, r8=jump flag
' ra=bull speed, rd=operations deck, rn=matador speed
' re, rf, and rg=ladder hot spots, r1= prize-collection
loop stopper
'
''''' at the moment, it appears 4 jumps at same label
brings autotest error
'
 L R0=0;  L R2=0;  L R8=0;
'
* read the joystick
'
A: P;
B: If J1&16 Jump F;
C: If J1&4  Jump G;
D: If J1&8  Jump H;
E: If J1&1  Jump I;
'
* lastly, check if bull collided with stationary matador.
'
  If BC(0,1,4) J P;  J A;
'
* if not already jumping, set 'i am jumping' flag, jump
quickly, pause for a
' period whose length is relative to the bull's speed,
check for collisions
' bulls while slowly descending.
'
F: If R8=1 J A;  L R8=1;  L Y=Y-25;  F R0=1 T RQ  N R0;
   F R0=1 T 25  If BC(0,1,4) J P;  L Y=Y+1;  N R0;  L
R8=0;  J A;
'
* return to reading joystick if move would cause clipping
'
G: If X > 8    J J;  J A;
H: If X < 312  J K;  J A;
'
I: If R2=1 J A;  L R8=0;  If RD=0 J L;  If RD=1 J M;  If
RD=2 J N;
'
* pick l or r image, reset jump/climb flags, move matador
using a f to n loop
* so that the cpu will make little diff, check bull
collide.
'
J: Let A=6; L R2=0; L R8=0; F R0=1 T 2 L X=X-RN; If
BC(0,1,4) J P; N R0; J A;
K: Let A=8; L R2=0; L R8=0; F R0=1 T 2 L X=X+RN; If
BC(0,1,4) J P; N R0; J A;
'
* determine proximitiy of matador's hot spot with
pertinate ladder's
'
L: L R7=RE-X;  J O;
M: L R7=RF-X;  J O;
N: L R7=RG-X;  J O;
```

(continued on page 68)

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Programming the Amiga in Assembly Language

Part VI - Gadgets, Strings, and Other Things

by William P. Nee

In this article I'll discuss gadgets, creating a string gadget, using the BORDER structure and text, how to scale numbers, and use the Intuition message structure to make a zoom routine. We'll write a Mandelbrot/Julia program to tie all this together.

Menu Macro

But first, some old business. In the last article (V2.4) I discussed menus, items, and sub-items; this code took up a lot of room in the program and I suggested you devise your own macros to cut down on some of the repetitive work. Here's how I wrote my macros—included in the MENU.i listing on this disk.

```
MAKEMENU MACRO
                                    ;\1 = this menu (menu0, menu1. etc.)
\1                                  ;\2 = 'menu title'
            IFNC        '\3',''     ;\3 = next menu or ,,
            DC.L        \3          ;\4 = left edge (0,100,200...)
            ENDC                    ;\5 = $flags ($1=enabled, $0=disabled)
            IFC         '\3',''
            DC.L        0
            ENDC
            DC.W        \4,0,90,0,\5
            DC.L        \1TITLE             ;title pointer
            DC.L        \1ITEM0             ;first item structure pointer
            DC.W        0,0,0,0
            EVENPC
\1TITLE     DC.B        \2,0                ;reserve space for title
            EVENPC
            ENDM
```

The first part of the macro checks to see if there is another menu title; if so, it makes this the first entry and if not, it makes the first entry a NULL. The next entry is the left-edge followed by a top-edge of 0. The width is set to 90 and the height is NULL. Your menu flag is next and the macro then fills in the pointer to the menu title and the first item structure. The four unused words complete the structure. The menu title, your second parameter, completes the macro. This macro would be used as:

```
MAKEMENU MENU0,'Project',MENU1,0,1
```

Notice the \1 and \1TITLE used to make the headings. This is the menu that the OPENMENU macro looks for.

Item Macro

Next, and a little more complicated, is the item macro. Now we have to pass a few more parameters. Here's one way to write it:

```
MAKEITEM MACRO                                  ;\1 = this item
(menu0item1, etc.)
\1                                                      ;\2 = 'item
name'
            IFNC        '\3',''                 ;\3 = next item or ,,
            DC.L        \3                              ;\4 = top
(0,10,20...)
            ENDC                                        ;\5 =
$flags
            IFC         '\3',''                 ;\6 = $mutualexclude
or ,,
            DC.L        0                               ;\7 =
'command key' or ,,
            ENDC                                        ;\8 =
menu_item_subitem_ pointer
            DC.W        0,\4,130+COMMWIDTH,10,\5
            IFNC        '\6',''                 ;\6 <> nothing
            DC.L        \6
            ENDC
            IFC         '\6',''                 ;\6 = nothing
            DC.L        0
            ENDC
            DC.L        \1ITEXT                 ;IText structure
pointer
            IFNC        '\7',''                 ;\7 <> nothing
            DC.B        \7,0                            ;command
key, padding
            ENDC
            IFC         '\7',''                 ;\7 = nothing
            DC.B        0,0
            ENDC
            IFNC        '\8',''                 ;\8 <> nothing
            DC.L        \8                              ;pointer to
subitem structure
            ENDC
            IFC         '\8',''                 ;\8 = nothing
            DC.L        0
            ENDC
            DC.W        0
\1ITEXT
            DC.B        0,1,1,0                 ;front pen, back pen,
mode, padding
            DC.W        CHECKWIDTH,0            ;width offset
            DC.L        0,\1NAME,0
            EVENPC
\1NAME      DC.B        \2,0                    ;reserve space for
item name
            EVENPC
            ENDM
```

As with the menu macro, either the next item or NULL becomes the first macro variable. This is followed by a left-edge of 0, your top location, a width of 130 plus room for the command key and symbol, and a height of 10. Your flags for this item are next, followed by the mutual exclude, if any, the pointer to the IText structure, your command key, if any, and the pointer to any subitem structure. A next select of 0 finishes this part. The IText portion includes a left-edge offset of CHECKWIDTH to always allow for the check mark. The item

name completes the macro. An example of this macro would be:

```
MAKEITEM MENU1ITEM0,'ItCount',,0,$52,,MENU1ITEM0SUBITEM0
SUBITEM MACRO
```

The macro for creating subitems is very much like the item macro and passes all but the last parameter.

```
MAKESUBITEM MACRO                              ;\1 = this subitem
(menu0item0subitem0)
\1                                                          ;\2 =
'subitem name'
          IFNC      '\3',''                    ;\3 = next subitem or
,,
          DC.L      \3                                      ;\4 = top
(0,10,20...)
          ENDC                                            ;\5 =
$flags
          IFC       '\3',''                    ;\6 = $mutualexclude
or ,,
          DC.L      0                                       ;\7 =
'command key'
          ENDC
          DC.W      65,\4,130+COMWIDTH,10,\5
          IFNC      '\6',''                    ;\6 <> nothing
          DC.L      \6                                      ;mutual
exclude
          ENDC
          IFC       '\6',''                    ;\6 = nothing
          DC.L      0
          ENDC
          DC.L      \1ITEXT,0                  ;IText structure
pointer
          IFNC      '\7',''
          DC.B      \7,0                                    ;command
key, padding
          ENDC
          IFC       '\7',''
          DC.B      0,0
          ENDC
          DC.L      0                                       ;no sub-
item structure
          DC.W      0
          EVENPC
\1ITEXT
          DC.B      0,1,1,0                    ;front pen, back pen,
mode, padding
          DC.W      CHECKWIDTH,0               ;width offset
          DC.L      0,\1NAME,0
          EVENPC
\1NAME    DC.B      \2,0                       ;reserve space for
name
          EVENPC
          ENDM
```

Notice that I have subitems starting 65 spaces out from the menu strip and they include room for the check mark and command key. An example of the subitem macro would be:

```
MAKESUBITEM MENU1ITEM0SUBITEM0,'64',MENU1ITEM0SUBITEM1,0,$153,$1E
```

These three macros are "generic" in that they all produce the same size and style menu, item, and subitem. You could REM portions or change parts of any macro, but be sure to keep the original intact. If you've got your own macros, by all means use them, and adjust the program accordingly.

Gadgets

Now let's see how you can communicate with your program by using gadgets. Intuition provides several System gadgets—closing, front/back, drag, etc.—but you can also custom-design your own. In general, there are three types of gadgets:

1) Boolian ($1) - ON/OFF button
2) Proportional ($3) - a sliding knob inside a container
3) String ($4) - allows entry of a string or a long integer number

These gadgets can be highlighted just like menus and can have text associated with them. You may design your own images for the regular and highlighted gadget or enclose them in a border. I'll save image-making for a later article, but we will use a border.

Borders

The border function of Intuition graphics will draw lines between any given sets of coordinates relative to the container they're inside. The border structure is in the second half of Table II. The left-edge and the top-edge are offsets from the container box so they're usually negative numbers. The draw mode is either JAM1 or COMPLIMENT/XOR. Let your gadget know there will be a border by including the border structure pointer in the gadget structure. In addition to attaching a border structure to your gadget you can draw lines anytime using the DrawBorder function. Set up this function with:

A0 = RASTPORT
A1 = BORDER STRUCTURE POINTER
D0 = X COORDINATE OFFSET
D1 = Y COORDINATE OFFSET

You could draw the same lines at several different places on the screen by changing d0 and d1.

Gadgets are structured items as outlined in Table I. As with most major structures, the first entry is a pointer to the next gadget's structure. The locations for the gadget are next followed by the various flag options. Flags for gadgets are:

```
GADGHCOMP ($0) - complement the cursor; used for string gadgets
GADGHBOX ($1) - draw a box around the gadget
GADGHIMAGE ($2) - a highlighted image or border
GADGHNONE ($3) - no highlighting
GADGIMAGE ($4) - user defined image
GRELBOTTOM ($8) - top-edge is relative to bottom
GRELRIGHT ($10) - left-edge is relative to right-edge
GRELWIDTH ($20) - width is relative to window width
GRELHEIGHT ($40) - height is relative to window height
SELECTED ($80) - starts on and highlighted if toggled
GADGDISABLED ($100) - starts off and disabled
```

To better understand the GREL options, if you set the height to 9 the gadget will be nine lines high; but set height to -50 along with GRELHEIGHT and the gadget will be 50 lines smaller than its element, the window. A width of -100 combined with GRELWIDTH will produce a gadget 100 pixels smaller than the window width. In the same manner, GRELRIGHT has the starting point relative to the right side of the window and GRELBOTTOM has the starting line relative to the window bottom. These flags let you place a gadget inside any size window using any screen mode (320 X 200, 640 X 200, etc.).

The Activation flags produce desired effects and further define the gadget. Activation flags are:

```
RELVERIFY ($1) - active when LMB is released over the gadget
GADGIMMEDIATE ($2) - know immediately when gadget selected
ENDGADGET ($4) - make a requester gadget go away
FOLLOWMOUSE ($8) - follows the mouse; for proportional gadgets
RIGHTBORDER ($10) - adjust the window border
LEFTBORDER ($20) - adjust the window border
TOPBORDER ($40) - adjust the window border
BOTTOMBORDER ($80) - adjust the window border
TOGGLESELECT ($100) - toggle ON/OFF status
STRINGCENTER ($200) - center justify a string entry
STRINGRIGHT ($400) - right justify a string entry
LONGINT ($800) - string must be a long integer
```

```
ALTKEYMAP ($1000) - there will be an alternate keymap
BOOLEXTEND ($2000) - there is a Boolean info structure
```

The BORDER options may be used to change the size of a window's border so you can place your gadget there. TOGGLESELECT is used in conjunction with the SELECTED flag. STRINGCENTER/RIGHT will position the placement of your string information as you enter it in the gadget box—like the RENAME function in WorkBench. LONGINT lets Intuition know your string will only be a long integer (32-bits, signed).

Next in the structure is the gadget type. This is followed by three pointers to an image/border structure, highlighted image/border structure, and an IntuiText structure. After the mutualexclude is a pointer to further information for proportional or string gadgets. You may include a gadget number to define which gadget is in use as well as your own structure pointer at the end of the gadget structure. Intuition will disregard these last two entries.

Various flags, activation flags, and structure elements must be combined to produce the desired results. The major combinations are:

```
FLAGS                    ACTIVATION                    STRUCTURE
SELECTED ($80)           TOGGLESELECT ($100)   MUTUALEXCLUDE
GADGIMAGE ($4)                                                IMAGE/
BORDER POINTER
GADGHIMAGE ($2)                                               H.IMAGE/
H.BORDER POINTER
```

For this listing all the gadgets will use their own shape and be in their regular locations, so I used a flag of $0 and, since I wanted to know only when the LMB was released, I used an activation flag of $1.

STRINGINFO

If your gadget is a string or proportional type you must also include an info structure. Since I'll only be using string gadgets, I'll discuss some of the items in the stringinfo structure outlined in Table II. Each string must have a buffer where the string will be stored and this buffer must be NULL terminated. You may also have an optional undobuffer where the last string entry can be recalled using AMIGA/Q. Since only one string gadget is active at a time, multiple gadgets can share the undobuffer. In this article, though, I'll have separate undobuffers for each string gadget.

The maximum numbers of characters allowed in the buffer must also include that NULL terminating zero. Intuition maintains the next several fields but you can look up their values as an offset from the stringinfo structure. If you're going to have a long integer string gadget, you must not only set the LONGINT ($800) activation flag, but must also include the initial long integer in the stringinfo structure. As this integer changes, you can look up its value. If you have an alternate keymap, set the ALTKEYMAP ($1000) activation flag and include its location as the last item in the stringinfo structure.

STRGADGET MACRO

As you can see, it takes a lot of code to define several string gadgets. Listing 1 will use six gadgets and would require 168 additional lines of program code to describe all of them. Again, we'll use macros that will shorten the work for us. Since there are so many string possibilities, we'll have to pass 12 items, but if you want your macro to be more generic you could cut down on some of them. My string gadget macro follows the format of the menuitem macro:

```
MAKESTRGADGET MACRO
\1
;\1 = this string gadget
            IFNC        '\3',''                                 ;\2 =
'string gadget name'
            DC.L        \3
;\3 = next string gadget
            ENDC
;\4 = left-edge offset
            IFC         '\3',''                                 ;\5 = top-
edge offset
            DC.L        0
;\6 = width
            ENDC
;\7 = height
            DC.W        \4,\5,\6,\7                 ;\8 = $flags
            DC.W        \8,\9,4                                 ;\9 =
$activation
            DC.L        \1BORDER,0                  ;\10 = $mutualexclude
or ,,
            DC.L        \1ITEXT,\10                 ;\11 = id# or ,,
            DC.L        \1INFO                                  ;\12 = max
# of characters
            DC.W        \11
            DC.L        0
            EVENPC
\1INFO
            DC.L        \1BUFFER,\1UNDOBUFFER  ;buffer, undobuffer pointers
            DC.W        0,\12,0,0,0,0,0,0
            DC.L        0,0,0
            EVENPC
\1BORDER
            DC.W        -2,-2                                   ;starting
offsets
            DC.B        1,0,0,5
            DC.L        \1POINTS,0                  ;pointer to coordi-
nates
            EVENPC
\1POINTS
            DC.W        0,0,\6+4,0,\6+4,\7+4,0,\7+4,0,0
            EVENPC
\1ITEXT
            DC.B        0,1,1,0
            DC.W        0,-11
            DC.L        0,\1NAME,0
            EVENPC
\1NAME      DC.B        \2,0                                    ;reserve
space for name
            EVENPC
\1BUFFER
            DS.B        \12-1                                   ;reserve
buffer space
            DC.B        0
            EVENPC
\1UNDOBUFFER
            DS.B        \12-1                                   ;reserve
undobuffer space
            DC.B        0
            EVENPC
            ENDM
```

Let's look at this macro in a little more detail. The first item is either the pointer to another string gadget or 0. This is followed by the locations for your gadget, flags, activation flags, and the type gadget (4). Each gadget has a border pointer, no highlighting pointer, an IntuiText pointer, no mutualexclude, and a stringinfo pointer. Your id# follows and there is no pointer to an optional structure.

The stringinfo portion has both a buffer and undobuffer pointer. Characters will start printing at position 0 in the gadget box and you define how many characters there may be. The border offsets are two pixels to the left and two lines above the gadget container. There are five pairs of coordinates to get back to the origin. The five pairs are (0,0), (your width+4,0), (your width+4, your height+4), (0, your height+4), and (0,0). The IntuiText starts 11 lines above the container. Space is reserved for each buffer and is one byte less than you want plus the NULL terminating 0.

The easiest way to include your gadgets is to add the pointer to the first gadget to your window structure, offset 18. You can remove the gadgets by replacing the pointer with a NULL; this is what the

REMOVEGADGETS macro does. All of these macros and the appropriate flag values have been added to MENU.i included on this disk.

The Program

Now let's put all of this knowledge to use in a program. In the last article I talked about the Julia Set and showed you how to draw it using double-precision math. This time we'll draw the Mandelbrot Set using scaled numbers. There will be a string gadget for each of the variables—Xleft, Xright, Ybottom, Ytop, JuliaA, and JuliaB; you can put whatever values you want in these strings. Menu selections will let you pick a program to draw either Mandelbrot or Julia, go back to the coordinates, or quit the program. Another menu selection will let you pick a maximum iteration count from 64 (the default count) to 1024. During any part of the drawing you can use the LMB to pick the upper-left corner of a zoom box, drag down to the lower-right corner, release the button and recompute new coordinates to draw. The original values in the string gadgets will not change. I know there are quicker ways to draw the Mandelbrot Set, but this is a program designed to show you how to use menus, gadgets, and IntuiMessage.

To review, the Julia Set was derived by continuously squaring a complex number and adding a fixed number to the result. Keep repeating this until the value of the number exceeds 4, or you reach the maximum iteration count. Numbers that never exceed 4 are part of the Julia Set and usually colored black. Numbers that exceed 4 are usually colored based on the iteration count at that point. This process is repeated for every complex number within a grid. Remember that a complex number Z is represented as X+iY where i is the square root of -1, so i*i=-1. The real part of a complex number is the X portion and the imaginary part is the Y portion. The complex number Z squared is (X+iY)*(X+iY) or X^2+2iXY+i^2Y^2. Since i^2=-1, new Z is X^2-Y^2+i2XY; the new real portion is (X^2-Y^2) and the new imaginary portion is 2XY. Then JuliaA and JuliaB are added to the real portion and imaginary portion respectively.

The only difference between the Julia and Mandelbrot computations is the number added to the new real and imaginary portions. Constant Julia values are added to the Julia Set; continuously varying values, the Xcorner and Ycorner are added to the Mandelbrot Set. Here are the two programs in BASIC to show you the difference.

```
 JULIA SET
XLEFT=-2:XRIGHT=2:XSCALE=(XRIGHT-XLEFT)/64
YBOTTOM=-2:YTOP=2:YSCALE=(YTOP-YBOTTOM)/64
JULIAA=-1.5:JULIAB=0:MAXCOUNT=64
 FOR H=0 TO 64:XCORNER=XLEFT+H*XSCALE
 FOR V=0 TO 64:YCORNER=YBOTTOM+V*YSCALE
 A=XCORNER:B=YCORNER
 FOR C=0 TO MAXCOUNT:ASQR=A*A:BSQR=B*B
 IF ASQR+BSQR=>4 THEN COLOR_ROUTINE:GOTO LOOP
B=2*A*B+JULIAB:A=ASQR-BSQR+JULIAA
 NEXT C
 LOOP:NEXT V,H
 MANDELBROT SET
XLEFT=-2:XRIGHT=2:XSCALE=(XRIGHT-XLEFT)/64
YBOTTOM=-2:YTOP=2:YSCALE=(YTOP-YBOTTOM)/64
 MAXCOUNT=64
 FOR H=0 TO 64:XCORNER=XLEFT+H*XSCALE
 FOR V=0 TO 64:YCORNER=YBOTTOM+V*YSCALE
 A=XCORNER:B=YCORNER
 FOR C=0 TO MAXCOUNT:ASQR=A*A:BSQR=B*B
 IF ASQR+BSQR=>4 THEN COLOR_ROUTINE:GOTO LOOP
B=2*A*B+YCORNER:A=ASQR-BSQR+XCORNER
 NEXT C
 LOOP:NEXT V,H
```

Two different ways to color a point are to AND the iteration count with #31 or to shift it enough to the right to get a value from 0 to 31. The first method may produce a jumble of colors where there should be a pattern.

Scaling Numbers

When we computed the Julia Set I used double-precision floating-point numbers, but this time we'll scale each number by multiplying it by a large factor and then use the registers for regular multiplication rather than the slower MATHIEEEDOUBBAS dp functions. The scale in this program is 2^29. The first step is to convert the string to a dp number just as in the Julia program, but then use the MSCALE macro to multiply it by 2^29 (as a dp number) and then move it back to d0 as a whole number. This is done for each string value and the scaled numbers are stored in XC, YC, JULIAA, and JULIAB. The difference between Xright and Xleft is divided by 320 and stored in XSCALE; the difference between Ytop and Ybottom is divided by 200 and stored in YSCALE.

If you pick the menu option MANDELBROT, the Julia flag is set to 0; if you pick the JULIA option, it's set to 1. The CFM macro does not use Wait since we want the program to keep drawing unless a menu item or the zoom routine is picked. We also need the mouseX and mouseY coordinates so I rewrote the CFM macro as follows:

```
CFM MACRO                                   ;<branch to if no message>
            MOVEA.L     WINDOW,A0
            MOVE.L      #MENUNULL,D0
            INTLIB      ONMENU
            MOVEA.L     WINDOW,A0
            MOVEA.L     WW.USERPORT(A0),A0
            SYSLIB      GETMSG
            TST.L       D0
            BEQ                 \1
            MOVEA.L     D0,A1
            MOVE.L      IM.CLASS(A1),D2         ;IDCMP flags
            MOVE.W      IM.CODE(A1),D3                  ;menu#, LMB/RMB up/
down, etc.
            MOVE.W      IM.QUALIFIER(A1),D4     ;rawkey code
            MOVEA.L     IM.IADDRESS(A1),A0      ;address
            MOVE.W      IM.MOUSEX(A1),D5        ;X coordinate
            MOVE.W      IM.MOUSEY(A1),D6        ;Y coordinate
            SYSLIB      REPLYMSG
            ENDM
```

Now let's go through Listing 1 in detail and review all of the subroutines. There are six include files necessary to run this program. Even though we're going to scale numbers, I still used DPMATHMACROS.i for division and to move multiple registers around. MULR is my macro for multiplying the unsigned values in d0 and d1 with the result in d2/d3. It uses shifts and rotate commands rather than the MULU function. ZMUL will be used to multiply two labels with the result in d0. The current iteration count is stored in register a2 and your maximum iteration count is in a3. Using registers rather than labels to store these frequently called values will speed up the program a little.

@PSET is a variation of the PSET macro so I put the @ sign before it to keep the assembler from becoming confused. MSCALE will multiply a dp value in d0/d1 by 2^29, return the result in d0, and save it in the passed location. BEEP will flash the screen when called, acting as sort of a minor alert. More about using it later. After the libraries are opened the screen and window are set up along with an initial maximum iteration count of 64.

When you first see the program there will be six string gadgets on the screen filled with default Mandelbrot values. You may use these values or click in any box with the LMB and change the values or you can use AMIGA/X to erase the block; use AMIGA/Q to restore the last entered value. When you've changed values, press <ENTER> and then

change whatever other values you want. The Mandelbrot program does not use JuliaA and JuliaB; the Julia program display is generally between -1.5 and 1.5 in both directions unless you want to zoom in on a portion of it.

The message check sits there patiently waiting to see if you've picked a menu option. I have it set to only react to the Project menu. When you choose either Mandelbrot or Julia the respective flag is set and the program starts to compute the scaled coordinates. The first step is to remove the existing gadgets otherwise you could still click inside the invisible box and get a cursor along with the current string value—this does not make for an interesting display. The string value in each of the six buffers is converted to a dp number using the CONVERTDP macro I discussed in the previous article. The dp value is then scaled by multiplying it by 2^29; the scaled Xleft value is stored in XC. When the new Xright value is computed it's not saved since it doesn't enter into the calculations, but the previously saved Xleft is subtracted from it. This difference is divided by 320, scaled, and saved as XSCALE. The same procedure is followed with Ybottom except that the difference between Ytop and Ybottom is divided by 200 before scaling it. Finally the JuliaA and JuliaB values are always scaled and saved.

Since they will keep changing, the original XC and YC are resaved as XLOC and YLOC; for each loop they are also saved as ALOC and BLOC. The current count and sign flag are both set to 0. Now check the value in ALOC for it's sign; if it's negative, negate it and add 1 to the sign flag. Then use MULR to square the value. Remember that this value is actually ALOC*ALOC*SCALE*SCALE. Repeat the same procedure with BLOC and then add ASQR+BSQR. ADDX.L will include any carry from d1+d3 when you add d0 and d2. Compare the first half of the number (in d2) to #$10000000 which is the left half of 4*SCALE*SCALE. If it's less, we'll go on to compute the new imaginary portion of our number. If it isn't less, use one of the optional coloring programs to fix the color, set the point, and then branch to FIN.

New Z

The new imaginary portion is 2*ALOC*BLOC, but again, since each value is scaled, just multiplying would produce a new value of 2*ALOC*SCALE*BLOC*SCALE. So we'll have to multiply then divide our answer by SCALE to get a single scaled value. Rather than multiply by two and then divide by 2^29 we'll just divide by 2^28, eliminating one step. Division is accomplished using 28 right shifts; ROXR.L will include any carry from the ASR.L of d2. If the sign flag contains a one the value in d2/d3 is negative. Finally, if the Julia flag is set, JuliaB is added else YLOC is added, resulting in the new imaginary portion.

Now the new real portion must be computed. Its value is ALOC*ALOC-BLOC*BLOC. But again, since each value is scaled the final answer will be too large and must be divided by the scale. We already have the values saved for ASQR and BSQR so subtract them and divide by the scale using 29 right shifts. Add either JuliaA or XLOC and there's the new real portion of our new complex number.

Increase count by one and compare it to the maximum count—both values are actually in address registers. If the current count is below the maximum, branch to AGAIN. If the maximum count is reached the location is inside one of the two sets, so either leave it the background color or set it to the color of your choice. Then add the YSCALE to YLOC to get the next coordinate.

At this point we need to check for any messages; you could decide to pick menu0, menu1, or begin the zoom routine. If the CFM macro does not receive a message the program branches to NO_MESSAGE where the down distance is increased by one and if we're not at the bottom of the screen the program goes back to ML2. If there is a message however, the program must check to see it it's a MENUPICK or a MOUSEBUTTON; if it's neither, then again branch to NO_MESSAGE.

If there is a MENUPICK then the menu, item, and subitem number are computed. In menu0 you could select Mandelbrot in which case the julia flag would be cleared and the program jumps to START. Likewise, if you choose Julia the julia flag is set and the program jumps to start. If you pick Coordinates the program clears the screen, closes the menustrip and window, then jumps to the MAKE_WINDOW routine where the window is reopened along with it's gadgets. Finally, you could opt for Quit in which case the program would branch to CLOSE_WINDOW and end the program. If you don't choose any of these items the program branches to NO_MESSAGE. You can select menu items by using either the LMB or the item's corresponding command key.

Or you might have chosen menu1 and one of its five subitems. Depending on which subitem is selected, the new maximum iteration count is stored in MAXCOUNT (register a3). Since no further action is needed the program immediately jumps to NO_MESSAGE after you change the iteration count.

ZOOM

If you activate the MOUSEBUTTON flag by pressing the LMB the program branches to ZOOM. The values in MouseX and MouseY are made into words, stored in STARTX and STARTY, and the draw mode switched to complement. With this mode a line drawn over itself restores the original pixel values under it. Another message check is made to see if you move the mouse or release the LMB. When you do release the LMB, the IM.CODE in d3 will equal SELECTUP (#$E8). If you haven't released the button, the coordinates in MouseX and MouseY are now stored in ENDX and ENDY. The BOX macro will draw a box connecting STARTX, STARTY, ENDX, and ENDY. After an optional delay the same box is redrawn restoring the original color of the pixels under the line. The program then branches back to the message check.

When the message check says there's a MOUSEBUTTON and the code says it's SELECTUP, the program branches to LMB_UP. There the original mode of JAM1 is restored, then ZMUL is used to multiply XSCALE*STARTX. The result is added to XC and saved as NEWXC; this is already a scaled number. Then multiply XSCALE times ENDX, add it to XC, and subtract the just computed NEWXC to get the distance between your X points. Convert this to a dp number, divide by 320, return it as a whole number in d0, and save it as the new XSCALE. Before saving it, however, check to be sure the scale is at least 1, otherwise you've exceeded the program's maximum zoom capability. If it is a 0, change it to one and BEEP the screen to let the user know there's no more zooming.

The same procedure is repeated with YSCALE, but, since the bottom of the screen is actually line 200 and the top is actually 0, you must reverse everything. Subtract ENDY from 200 then multiply by YSCALE, add YC, and save the result as NEWYC. Subtract STARTY from 200, multiply by YSCALE, add YC, subtract NEWYC, and divide by 200. Again test this number to be sure the new YSCALE is not 0 and

BEEP if it is. When all of the new locations and scales have been computed, branch to SHOWIT. These new locations do not affect the values in the string buffers, nor do you know what they are.

The final routine adds the XSCALE to XLOC, increases the across distance by 1, and, if we're not done, branches to ML1. If the drawing is complete the program branches back to the message check to see what you want to do.

The variables XC, YC, XSCALE, and YSCALE have been computed for the default values of -2, 2, -2, and 2. Because I wanted these values to appear in the string gadgets I REM'd the buffer portion of MAKESTRGADGET macro and used buffers at the end of the listing filled with the desired values; notice that each one must be NULL terminated. Assemble this program using A68K as M\J, or copy it from the enclosed disk.

I hope this article has helped you to understand IDCMP flags, IntuiMessages, and how they work together with menus and gadgets. Some changes you might want to make to this program are to disable portions of the menu that aren't in use, react to menu1 at the start of the program, and to replace new coordinates in their respective string buffers. Experiment with the string gadget placement, menu colors, and text colors. Most of all, keep working with assembly language; the more you use it, the easier it becomes. And let those macros do a lot of the work for you.

TABLE I

TABLE I
GADGET STRUCTURE (44 BYTES)

0	LONG	POINTER TO NEXT GADGET STRUCTURE			
4	WORD	LEFT-EDGE RELATIVE TO WINDOW			
6	WORD	TOP-EDGE RELATIVE TO WINDOW			
8	WORD	WIDTH OF GADGET BOX			
10	WORD	HEIGHT OF GADGET BOX			
12	WORD	FLAGS			
		GADGHCOMP ($0)	GADGHBOX ($1)	GADGHIMAGE ($2)	GADGHNONE ($3)
		GADGIMAGE ($4)	GRELBOTTOM ($8)	GRELRIGHT ($10)	GRELWIDTH ($20)
		GRELHEIGHT ($40)	SELECTED ($80)	GADGDISABLED ($100)	
14	WORD	ACTIVATION			
		RELVERIFY ($1)	GADGIMMEDIATE ($2)	ENDGADGET ($4)	FOLLOWMOUSE ($8)
		RIGHTBORDER ($10)	LEFTBORDER ($20)	TOPBORDER ($40)	
		BOTTOMBORDER ($80)	TOGGLESELECT ($100)	STRINGCENTER ($200)	STRINGRIGHT ($400)
		LONGINT ($800)	ALTKEYMAP ($1000)	BOOLEXTEND ($2000)	
16	WORD	GADGET TYPE			
		BOOLGADGET ($1)	PROPGADGET ($2)		
		STRGADGET ($4)	REQGADGET ($1000)	GZZGADGET ($2000)	
18	LONG	POINTER TO IMAGE OR BORDER STRUCTURE			
22	LONG	POINTER TO HIGHLIGHTED IMAGE OR BORDER STRUCTURE			
26	LONG	POINTER TO GADGET'S INTUITEXT STRUCTURE			
30	LONG	MUTUALEXCLUDE			
34	LONG	POINTER TO PROPINFO OR STRINGINFO STRUCTURE			
38	WORD	USER-DEFINED GADGET NUMBER			
40	LONG	POINTER TO USER-DEFINED STRUCTURE			

TABLE II

STRINGINFO STRUCTURE (36 BYTES)

0	LONG	POINTER TO STRING BUFFER
4	LONG	POINTER TO STRING UNDOBUFFER
8	WORD	CURSOR LOCATION IN THE BUFFER
10	WORD	MAXIMUM NUMBER OF CHARACTERS IN THE BUFFER
12	WORD	FIRST CHARACTER LOCATION IN THE BUFFER
14	WORD	CHARACTER POSITION IN THE UNDOBUFFER - INT SET
16	WORD	NUMBER OF CHARACTERS IN THE BUFFER - INT SET
18	WORD	NUMBER OF VISIBLE CHARACTERS - INT SET
20	WORD	LEFT-OFFSET OF CONTAINER - INT SET
22	WORD	TOP-OFFSET OF CONTAINER - INT SET
24	LONG	POINTER TO LAYER STRUCTURE - INT SET
28	LONG	VALUE OF THE LONG INTEGER - INT SET
32	LONG	POINTER TO AN ALTERNATE KEYMAP

BORDER STRUCTURE (16 BYTES)

0	WORD	STARTING LEFT-EDGE RELATIVE TO CONTAINER
2	WORD	STARTING TOP-EDGE RELATIVE TO CONTAINER
4	BYTE	FRONT PEN COLOR
5	BYTE	BACK PEN COLOR - UNUSED
6	BYTE	DRAW MODE - JAM1 OR XOR
7	BYTE	NUMBER OF PAIRS OF COORDINATES
8	LONG	POINTER TO A TABLE OF COORDINATES
12	LONG	POINTER TO NEXT BORDER STRUCTURE

Listing 1

```
;LISTING 1
;Mandelbrot/Julia Set - scale factor 2^29
  include execmacros.i
  include intmacros.i
  include gfxmacros.i
  include dosmacros.i
  include dpmathmacros.i
   include menu.i
mulr  macro    ;<d0*d1 -> d2,d3>
      moveq    #0,d2
      moveq    #0,d3
      moveq    #0,d4
      moveq    #31,d5
mr1\@ asl.l    #1,d3
      roxl.l   #1,d2
      asl.l    #1,d0
      bcc      mr2\@
      add.l    d1,d3
      addx.l   d4,d2
mr2\@ dbf      d5,mr1\@
      endm
zmul  macro
   move.l   \1,d0
   move.l   \2,d1
   move.w   d0,d2
   mulu     d1,d2
   swap     d0
   mulu     d1,d0
   swap     d0
   clr.w    d0
   add.l    d2,d0
   endm

depth equ 5
count equr  a2
maxcount equr  a3
```

```
@pset macro     ;<across,down>
   move.l    rp,a1
   move.w    \1,d0
   move.w    #199,d1       ;adjust down
   sub.w     \2,d1
   ext.l     d0
   ext.l     d1
   move.l    gfxbase,a6
   jsr       -324(a6)
   endm
mscale  macro   ;<move d0 to - >
  move.l    #$41c00000,d2  ;2^29 in fp
   moveq     #0,d3 .
   muldp                    ;scale it
   fixdp                    ;whole number in d0
   move.l    d0,\1          ;save it
   endm
beep    macro
  movea.l  screen,a0
  intlib  displaybeep
   endm

  move.l    sp,stack       ;save stack pointer
open_libs                  ;opmn all the libraries we
need
   openlib    int,done
   openlib    dos,close_int
   openlib    gfx,close_dos
   openlib    dpmath,close_gfx

setup:                     ;open a screen of 320 x 200
make_screen
  openscreen myscreen,close_libs
   movea.w    #64,maxcount
make_window
  openwindow mywindow,close_screen
   palette    colormap,32
   mode        jam1
   openmenu   menu0
msg_check
   cfm   msg_check
   cmpi.l  #menupick,d2
   bne.s   msg_check
  eval_menunumber
   tst.w    d0
   bne.s    msg_check
   tst.w    d1
   beq.s   is_mandelbrot
   cmpi.w   #1,d1
   beq.s    is_julia
   bra.s    msg_check
is_mandelbrot
   move.w   #0,julia
   bra.s    coordinates
is_julia
   move.w   #1,julia          ;flag julia
coordinates
   removegadgets             ;don't show gadgets
   lea      gadget1buffer,a0   ;X left
   convertdp                 ;make dp number
   movedp   d0,d6             ;save in d6/d7
   mscale   xc
   lea      gadget3buffer,a0   ;X right
  convertdp
   movedp   d6,d2             ;d2/d3 = X left
   subdp                     ;d0/d1 = X right - X left
   movedp   d0,d6            ;move difference to d6/d7
   fltdp    320               ;320 as dp number
   movedp   d0,d2             ;move to d2/d3
   movedp   d6,d0            ;move difference to d0/d1
   divdp                     ;difference / 320
   mscale   xscale

   lea      gadget4buffer,a0    ;Y bottom
  convertdp
   movedp   d0,d6
   mscale   yc
   lea      gadget2buffer,a0
  convertdp
   movedp   d6,d2
   subdp
   movedp   d0,d6
   fltdp    200
   movedp   d0,d2
   movedp   d6,d0
   divdp
   mscale   yscale

   lea      gadget5buffer,a0
  convertdp
   mscale   juliaa
   lea      gadget6buffer,a0
  convertdp
   mscale   juliab
;scaled_mandelbrot/julia_demo
showit
  movea.l  rp,a1
start
   pcls
  move.l   xc,xloc
  move.w   #0,across
ml1
  move.l   yc,yloc
  move.w   #0,down
ml2
  move.l   xloc,aloc
  move.l   yloc,bloc

  movea.w   #0,count
again
  move.w   #0,sign
testa
   move.l    aloc,d0          ;sign check
   bpl.s     squarea
   neg.l     d0
   move.l    d0,aloc
   addq.w    #1,sign
squarea
   move.l    d0,d1
   mulr
   move.l    d2,asqr          ;save d0
   move.l    d3,asqr4
testb
   move.l    bloc,d0
   bpl.s     squareb          ;sign check
   neg.l     d0
   move.l    d0,bloc
   addq.w    #1,sign
squareb
   move.l    d0,d1
   mulr
   move.l    d2,bsqr          ;save it
   move.l    d3,bsqr4
test4
```

```
  move.l  asqr,d0
  move.l  asqr4,d1
  add.l   d1,d3
  addx.l  d0,d2              ;d2,d3 = asquare +
bsquare
  cmp.l   #$10000000,d2      ;compare to 4
  blo.s   imag               ;branch if lower

  move.w  count,d0           ;count -> color
  andi.l  #31,d0             ;optional color1
  ;andi.l  #15,d0            ;optional color2
  ;addi.w  #16,d0
  ;lsr.l   #2,d0             ;optional color3
  foreground                 ;set apen
  @pset   across,down        ;pset the point
  bra     fin
imag
  move.l  aloc,d0
  move.l  bloc,d1
  mulr                       ;d2,d3 = aa * bb
  moveq   #28,d5             ;scale / 2
  cmpi.w  #1,sign            ;check if negative
  bne.s   scale2             ;branch if not
  neg.l   d3                 ; or change the value
  negx.l  d2                 ; of both registers
scale2
  asr.l   #1,d2              ;shift
  roxr.l  #1,d3              ; with carry
  subq.l  #1,d5
  bne.s   scale2
  tst.w   julia              ;computing Julia Set?
  bne.s   add_juliab
  add.l   yloc,d3            ;guess not
  bra.s   scale2a
add_juliab
  add.l   juliab,d3          ;guess so
scale2a
  move.l  d3,bloc            ;new imaginary part

real
  move.l  asqr,d0
  move.l  asqr4,d1
  move.l  bsqr,d2
  move.l  bsqr4,d3
  sub.l   d3,d1
  subx.l  d2,d0              ;d0 = asquare - bsquare
(real portion)
  move.l  #29,d5
scale1
  asr.l   #1,d0
  roxr.l  #1,d1
  subq.l  #1,d5
  bne.s   scale1
  tst.w   julia
  bne     add_juliaa
  add.l   xloc,d1
  bra.s   scale1a
add_juliaa
  add.l   juliaa,d1          ; plus juliaa
scale1a
  move.l  d1,aloc            ;new real part

  adda.w  #1,count           ;increase count
  cmpa.w  maxcount,count     ;up to maximum yet ?
  bne     again              ;branch if not
;  moveq.w  #17,d0           ;optional Set coloring
;  foreground                 ; or leave it black
;  @pset   across,down        ; by skipping it
fin
  move.l  yloc,d0
  add.l   yscale,d0          ;increase yloc by yscale
  move.l  d0,yloc

check_for_message
  cfm     no_message
  cmpi.l  #menupick,d2       ;a menu?
  beq.s   check_menus
  cmpi.l  #mousebuttons,d2   ;press lmb?
  beq     zoom
  bra     no_message         ;nothing .
check_menus
  eval_menunumber            ;get menu,item,subitem #
  tst.w   d0                 ;menu0?
  beq.s   handle_menu0
  cmpi.w  #1,d0              ;menu1?
  beq.s   handle_menu1
  bra     no_message
handle_menu0
  cmpi.w  #0,d1              ;item0?
  beq.s   do_mandelbrot
  cmpi.w  #1,d1              ;item1?
  beq.s   do_julia
  cmpi.w  #2,d1              ;item2?
  beq.s   do_coordinates
  cmpi.w  #3,d1              ;item3?
  beq     close_window
  bra     no_message
do_mandelbrot
  move.w  #0,julia           ;unflag julia
  bra     start
do_julia
  move.w  #1,julia           ;flag julia
  bra     start
do_coordinates
  pcls                       ;clear
  closemenu                  ; and
  closewindow                ;  close
  bra     make_window        ;redisplay gadgets
handle_menu1
  tst.w   d1                 ;subitem0?
  beq.s   do_itcount
  bra     no_message
do_itcount
  tst.w   d2
  beq.s   do_set64
  cmpi.w  #1,d2
  beq.s   do_set128
  cmpi.w  #2,d2
  beq.s   do_set256
  cmpi.w  #3,d2
  beq.s   do_set512
  cmpi.w  #4,d2
  beq.s   do_set1024
  bra     no_message
do_set64
  movea.w  #64,maxcount      ;reset maxcount
  bra     no_message
do_set128
  movea.w #128,maxcount
  bra     no_message
do_set256
```

(continued on page 66)

Porting a B+Tree Library to the Amiga...

by John Bushakra

Computer programmers are often faced with the daunting task of re-inventing the wheel. The users of our programs demand—rightfully—that they be able to share their information among all the different systems they may be using, and as programmers we must accommodate them in order to survive. But among programmers themselves, sharing information is quite a different story. As my father once told me, "The only people in this world who want you to have accurate information are the people you work for." Nowhere is this more true than in the computer software industry. To his observation, I can only add this parenthetical remark: sometimes, even the people you work for don't want you to have accurate information. In any event, the end result is that much of a computer programmer's time is spent re-inventing technology that someone else has already developed.

Anyway, this article isn't going to be a lecture about the evils of hoarding information. It's about porting a library of data management routines from the PC world to the Amiga world, and is meant to help other Amiga programmers, who might be sitting huddled in their caves, chiseling away on a programming tool that has already been implemented on the PC.

The product I'm referring to is called the C/Database Toolchest, and is available from Mix Software (the address is given at the end of this article). Mix Software is well known in the IBM world as the maker of a full blown C development environment which it sells for around—better sit down for this—$65. That price includes the compiler, source level debugger, library source code, a BCD business math package, and shipping. The C/Database Toolchest sells for $19.95, plus $10 for the C source code.

The product consists of a B+Tree library for managing index files, and an ISAM (Indexed Sequential Access Method) library, which manages both the indexing and data files needed by your application. There are numerous other utilities provided with the software. These include helpful debugging routines, functions for converting your data and index files to and from dBASE format, and compression routines—which essentially just physically remove deleted records from your data files. There is also a small database application called LDM, for Little Data Manager, which illustrates the use of the B+Tree and ISAM libraries. All source code is included with these utilities, including the LDM program. LDM uses typical character-based windowing functions and *Lotus*-style menu strips, but these could easily be replaced with their Amiga equivalents, to create a powerful database manager. A 350-page manual is also included with the package.

Presumably, a computer program is written with the intent of processing some type of information. The information of interest is often composed of several related data items, which are grouped together into data structures. When you design a data structure for your program, there will be one or two fields which you will want to use to identify a particular instance of the structure. The fields used for this purpose are called keys. For example, consider the following data structure:

```
struct person {
        char last_name[16], first_name[16];
        char address[32], phone[14], zip[10];
};
```

The last_name field is commonly used as a key field. Using this key, we might ask our database management software for a list of all the Smiths in our files. Or, if we used the zip field as a key, we could ask for all those people living within a certain zip-code.

Keys for a particular database are stored in an index file. An index, to quote the Toolchest manual, is "an ordered list containing pointers to data." The best illustration for this definition is the index in any text book. The index in a book is an ordered list of selected topics, and the page numbers given with each topic "point" you to the correct location in the book.

Every time a record is inserted into a data file, the data contained in the key fields of that record are written into the index file. Associated with each entry in the index file is a pointer, which shows where to look in the data file for the corresponding data record.

The records in the data file are stored in no particular order. The keys however, do have an order imposed on them. Ascending order using the ASCII collating scheme is frequently used, but most file management libraries, including the C/Database Toolchest, allow you to define your own key comparison functions. Keys provide us with a way to get different "views" of the information in our data files (for instance, all the Smiths living within a certain zip-code). But storing keys and data in separate files does not really give any increase in performance We would still have to perform a sequential search of the index file to find the data records we're interested in.

The trick, then, is to devise an efficient way of storing keys in the index file. Here is where the B+Tree library in the C/Database Toolchest (CBT for short) comes in. The CBT library contains routines for managing the index files used by your application. The keys in the index are stored using an implementation of the B+Tree algorithm, so the index is organized in an efficient manner. Very briefly, a B-Tree is a generalization of another type of tree data structure called a 2-3 tree—so called because all of the interior nodes of the tree have either two or three children. A B+tree is yet another variation of the B-Tree, which, among other things, allows you to store variable length records by default.

Records in the CBT index file consist of keys and items. An item is defined to be a long integer and is typically used as an offset pointer into a second, sequentially organized file, which contains the actual information used by your application, for example, the names, addresses, phone numbers, and zip codes for each person data structure, defined above.

The CBT library contains many functions that can be used to create and maintain your index files. Among the different types of functions available are stepping forward or backward through the index, moving to the head or tail of the index, locating a particular key and item, and deleting a particular key and item. As mentioned earlier, the CBT library allows variable length keys by default. Other B-Tree packages I've seen require considerable additional work to use variable length records. One other nice feature of the library is that it allows multiple keys to be stored in a single index file. This means that if you wanted to use two different fields of the person data structure as keys, say, last_name and zip, you could store both of them in the same index file.

Since only long integers can be stored with the keys in the index file, you will probably never use the CBT library directly. Instead, the file management portion of your application will use the ISAM library, which is built on top of the CBT library. With the ISAM library, your data records can take any format needed by your application.

As noted above, ISAM stands for Indexed Sequential Access Method. This external storage algorithm gives us a way to organize data so that it can be manipulated in two ways—randomly, and sequentially. That is, we can access any record, regardless of its position in the database, or we can access the records in the order they are physically stored in the data file.

The ISAM library manages both the index file and the data file, so it contains routines for manipulating keys, which in turn call the CBT functions, as well as its own I/O functions for managing insertions, deletions, and searching for records in the data file. Among many others, there are functions provided for creating the database, opening an existing database, defining key fields, and making indexes.

The ISAM library supports many advanced features, including variable length records—by default, like the CBT library. The library also allows you to create indexes "on the fly. This feature allows the user of your program to define a temporary key field with which to retrieve records. For example, you the programmer might create indexes for the last_name and zip fields of the person data structure. One time, however, the user needs a report sorted on the city field. He would indicate this to your program, and by calling a single ISAM function, you can construct an index for him using the city field. All the records in the data file are immediately accessible by the new index. When the report is finished, you can remove the index, again using only a single function call.

The ISAM library also supports segmented keys, or keys that are made of several different fields from your data structure. Again, using our venerable person data structure, suppose the user wanted to generate a report which lists all the records sorted in ascending order by the state field, and within each state, the user also wants the zip code of each person sorted in ascending order. We can do this for him by concatenating the state and zip fields into one key, and then using these six files include the standard header files string.h and stdlib.h,

...Using Mix Software's C/Database Toolchest...

with double quotes instead of the usual angle brackets (< >). If the quotes aren't replaced with brackets, the C compiler will look in the current directory for these two header files, instead of the directory assigned to the symbol INCLUDE:. The six offending files are bufpool.c, cbkey.c, ctrlrec.c, here.c, movekey.c, and btree.c.

The CBT library defines a data structure which it typedefs with the word Node. If you were never going to use the Exec Node structure, this wouldn't really cause any problems. It's highly, probable however, that you will be constructing lists of keys, and displaying them in those nifty scrolling list boxes that are so easy to make with the Amiga's new 2.0 operating system. The new list boxes make extensive use of Exec's List data structure, which of course uses Nodes to link the list together. In order to avoid conflicts, it's easier and safer to just give the CBT library Node structure a new name.

CBT's Node structure is referenced many times throughout the library, but we can easily change all the references at once, using the SPLAT utility that comes with the SAS C compiler. SPLAT is a program that takes a search pattern, a replacement string, and a set of files as input. When the search pattern is located in a file, it is changed to the replacement string. You will use SPLAT to search for all occurrences of the string "Node", and replace it with the string "CBNode". Only one command is needed to change all the CBT source files:

SPLAT -o Node CBNode #?.c #?.h #?.i

The -o option directs SPLAT to overwrite the original file. If you don't feel comfortable with this, then you can use the -d option to direct the output file to a different directory. I don't recommend letting SPLAT create files with the default .$$$ extension? AmigaDOS doesn't seem to like dollar signs as well as human beings.

Microsoft C uses a function called memmove() to copy bytes of memory from one location to another. There are two equivalents for this function in SAS C. The first is memcpy(), and the second is movmem(). When I compiled the CBT library with memcpy(), it simply refused to run. Unfortunately, I did not have a chance to research this problem fully. The solution is simply to use the movemem() function instead. You will have to change the order of the arguments, but that's not really a big deal. The source files that require this change are cbkey.c, here.c, and movekey.c.

Another Microsoft C memory function, memicmp(), is used in the CBT key comparison routine. The SAS C equivalent for memicmp() is memcmp(). The source file requiring this change is cbkeycmp.c.

The last change required before building the library is changing the Microsoft C make file to something that SAS C's LMK can digest. You will find a replacement file for LMK in listing one. Make files are used to describe the interdependencies of files that comprise a software application. Given a target, LMK examines the date and time stamp on the files that make up the target. Whenever a component of the target is found to be out-of-date, it is recompiled.

In this case, the target of the build is the library, CBT.LIB, and the components that make up the target are the object files produced by the compiler. Whenever the date and time stamp on the object file is older than the date and time stamp on the corresponding source file (i.e., the source file was modified more recently than the object file), the compiler is invoked to rebuild the object file. To make things more efficient, you can use the -R option, which instructs the compiler to replace the out-of-date object file in the specified library with the new one. Since LMK is smart enough to compile only the source files that are outdated, the -R option will allow us to only update the library for those object files that have been recompiled. Otherwise, we'd have to keep all the object files around on the hard disk, and rebuild the library from scratch, even if only one source file was modified.

To build the CBT library, type

LMK -f cbt.mak

When the process is done, you will find the CBT.LIB file in your LIB: directory.

Microsoft C uses a function called memmove() to copy bytes of memory from one location to another. There are two equivalents for this function in SAS C. The first is memcpy(), and the second is movmem().

The changes that need to be made to the ISAM library are equally simple. Like the CBT library, the easiest place to start porting the ISAM library is with changing some #include statements.

Some of the ISAM source files include files from the CBT library. Therefore, you will have to change the #include statements in these files, so the compiler will look in the directory into which you copied the CBT library source files. The ISAM files that require this change are? isam.i, isam.h, and createdb.c.

The level one I/O routines in Microsoft C require an include file called io.h. This file does not exist under SAS C, and this include must be changed to the file fcntl.h. There are seven files requiring this change, and they are addrec.c, closedb.c, createdb.c, getrec.c, getrlen.c, holes.c, and opendb.c.

When opening a database with the ISAM library, the only parameter required is the file name, without an extension. Both the open and create database functions automatically provide an extension of .IDX, and .DB for the index file and data file, respectively. The library functions go to great pains to strip an existing extension off the file name passed to them before opening or creating the database. Because AmigaDOS is less fussy about file names than MS-DOS, stripping an existing extension off the file name simply isn't needed. We can make the open and create functions somewhat simpler by

reworking them so that they only concatenate an extension of .IDX for the index file, and .DB for the data file. Since AmigaDOS allows multiple periods to appear in filenames, we can ignore an existing extension with no worries.

Begin this change by bringing up a file called filename.c in your text editor. There are two very similar functions defined in this file—one makes the data file name, and the other makes the index file name. Change these two functions so that all they do is strcpy() the filename passed in by the caller into the filename_buf buffer, then call the function chg_extent(), with the buffer, and the desired extension (either .DB or .IDX).

Also note that the default extensions .DB and .IDX are #defined in this file—these extensions can be changed to suit your needs.

Notice at the top of filename.c, a file called filename.h is included. This header file defines the maximum number of characters allowed in a drive prefix, path name, file name, and extension. They are all specified in terms of MS-DOS limitations, and need to be changed to the AmigaDOS equivalents. Specifically, a disk drive prefix is four characters (e.g., DH0:), a path name can be up to 256 characters, and a filename can be up to 31 characters. The default extension size is defined to be four characters (three letters, plus the dot). I elected not to change this, since I didn't change the default .DB and .IDX extensions. If you change these extensions, be sure to increase the size of the maximum file name extension accordingly.

If you look at the two functions in filename.c again, you will notice that they both call a function that appends the default extension to the file name. This function is defined in a file called chgextnt.c. Bring this file up in your text editor, and comment our the for() loop in the function chg_extent(). Rework the routine so that all it does is strcat() the extension onto the end of the file name buffer, and then return.

In making these changes, we've effectively bypassed the function defined in the file path.c. Therefore, we can remove this file from the make file provided for the ISAM library.

The next change is going to be a little difficult to explain, since I can't reproduce any of the ISAM source code for you in a listing. On a PC, when you declare an integer variable with only the int keyword, the compiler gives you 16 bits in which to store your integer. On the Amiga, the same declaration generates a 32-bit variable. Because of this difference, some changes are required to the routines that manage deleted records in the data file. These routines are defined in the file holes.c.

Bring this file up in your editor, and look at the function I_mk_size_key(). It's easy to see that this function operates on a 16-bit integer. First the upper eight bits are shifted right, and "masked" with 0xff, then the lower eight bits are masked with 0xff. This function needs to be changed so that it operates on a thirty-two bit integer.

First, change the function to shift the size parameter to the right by 24 bits and mask it with 0xff. Then shift it by 16 bits, and apply the mask. Shift it again by eight bits and apply the mask, and finally, apply the mask to the unshifted size parameter to get the lower eight bits. In short, make the function I_mk_size_key() look just like the function I_mk_offset_key(), with the obvious exception that I_mk_size_key() operates on the size parameter.

A similar change needs to be made to the function I_get_size(), in the same file. Like I_mk_size_key(), this function operates on a 16-bit integer, rather than 32-bit integer. To make a long story short, make I_get_size() look exactly like I_get_offset(), except that I_get_size() sets the size variable, not the offset variable.

The level one I/O routine open() accepts a file protection parameter, although the SAS C manual states that this parameter is ignored. Still, if you don't provide it, you will get warning messages when you compile the library. There are occurrences of the open() function in both opendb.c, and createdb.c. You can simply specify a zero as the last parameter to open(), and the compiler will be happy and content.

Another Microsoft C memory function, memicmp(), is used in the CBT key comparison routine. The SAS C equivalent for memicmp() is memcmp(). The source file requiring this change is cbkeycmp.c.

As its name implies, the file createdb.c has routines that create and initialize the database index and data files. Bring this file up in your editor and look at the function I_init_header(). The first thing this function does is lseek() eight bytes past the beginning of the freshly created data file. That might be just dandy in MS-DOS, but AmigaDOS will not be pleased at all if you try to seek past the beginning of an empty file. The call to lseek() needs to be commented out, and replaced with two write() statements that write out dummy values for the two variables, strings_length, and field_count. After the write() statements, the file marker will be positioned at the same place it would have been, had the lseek() call succeeded. When you insert the two write() statements, be sure to follow Mix Software's convention of checking the return value (in this case, the number of bytes written). If the value is not four (the size of a long integer), something is wrong, and you need to return the error value I_IO immediately.

After searching all the source files for the obvious changes given above, I compiled the ISAM source files, and built the library. My initial tests, creating, opening, inserting records and retrieving records were successful, but then something disturbing happened. After deleting a record, closing the database, and then re-opening the

database, the indexes I had defined seemed to have disappeared. A dump of the index file proved they were in fact still there, but the iopen_db() function would not read them. Managing deleted records is a major, complicated part of the ISAM library—no doubt this problem was not going to be easy to track down.

Whenever you insert a record in the data file, the data in the key field(s) of that record are also written in the index file. But keys aren't the only things stored in the index file. When you define an index, the name of that index is also written in the index file. Furthermore, whenever you delete a record, a key and item pair is written to the index file that tells where the "hole" is in the data file so that space can be re-used later. How does the ISAM library tell the difference between all of these key and item pairs in the index file? By prefixing each key with a signed byte that identifies the key as either the name of an index, a pointer to a hole in the data file, or an actual key that points to a valid record.

When you open up a database, the I_next_index() routine (in opendb.c) starts reading key/item pairs from the index file, trying to find all the names of the indexes you have defined. When it sees a key with a prefix byte that identifies that key as something other than the name of an index, it stops, thinking it has examined all the keys in the index file.

In this case, I_next_index() couldn't have been more wrong. The first key/item pair it was reading from the index file happened to be a pointer to a hole in the data file. It saw the prefix byte identifying it as such, and quit, before it even saw any index names.

Obviously, I can't provide you with the exact source code for I_next_index(). Fortunately, the changes that need to be made aren't that difficult. The function should remain basically the same—all parameters passed to it, and its local variables do not need to be changed. What the function should do is read keys one at a time, until it finds one with a zero byte prepended to it (the zero byte identifies the key as the name of an index). When such a key is found, it should return to its caller (I_ifopen()). The caller will do whatever processing is necessary on the returned key, and continue to call I_next_index() until it returns the value of EOI (for "end of index"). The down side of this solution is when the index file becomes very large, it could take some time to open the database. On the positive side, opening the database is something you are likely to do only once? afterward, you still gain all the speed benefits of the B+Tree storage algorithm. I'm not sure why this anomaly exists in the AmigaDOS port of the ISAM library. I've since run the LDM program on a PC, and experienced no such problems when deleting records.

Listing 2 has the make file for the ISAM library. There are two source files on the distribution diskette that use ROM BIOS interrupts to get the disk drive number and current directory. These two files aren't needed at all for AmigaDOS, and can be removed from the make file. To build the library, type:

LMK -f isam.mak

When the build is complete, you will find the file ISAM.LIB in the directory assigned to LIB:

Overall, I'm very impressed with the quality of the C/Database Toolchest. The entire system is well designed and coded. The 350-page manual that accompanies the package is a gem; it easily ranks among the best software documentation I've ever seen, on any platform. In addition to thoroughly explaining all of the functions in the libraries, it also contains a chapter with general information on the Indexed Sequential Access Method, and still another chapter on external tree data structures. This manual is well structured, well written, and informative as well as educational? indeed a rare find in today's software market.

The C/Database Toolchest seems to be right at home on the Amiga. It's a powerful and badly needed addition to any programmer's library. The moral of the story is, that if you can't find a programming tool you need to complete a project on the Amiga, come out of your cave and investigate the possibility of porting existing code. And if you do find something that is portable, by all means share the information with your fellow coders!

Mix Software
1132 Commerce Drive
Richardson, TX 75081
1-800-333-0330

Listing 1

```
# Listing One.  LMK file for building the CBT library.
# John Bushakra 06/10/91
#
#


CC=lc
FLAGS=-Rlib:cbt.lib
LIB=LIB:cbt.lib
HEADERS=cbtree.i bufpool.h ctlrec.h btree.h \
      cbtree.h cberr.h cbtree.cfg \
       bufpool.i member.h

$(LIB): cbinit.o cbcreate.o cbcurr.o cbexit.o cbclose.o \
      cbfind.o cbfindit.o cbflush.o cbfndmrk.o cbhead.o
\
      cbkey.o cbdepth.o cbkeylen.o cbmark.o cbmodify.o
\
      cbdelete.o cbnext.o cbopen.o cbprev.o cbprterr.o
\
       cbconmsg.o cberrmsg.o cbfcnmsg.o cbtail.o
curitem.o \
       locleaf.o posnext.o posfirst.o posprev.o
poslast.o \
      cbinsert.o root.o keyvalid.o makefit.o offleft.o
\
      offright.o insnode.o delnode.o joinnode.o
cbblksiz.o \
       ctlrec.o movekey.o space.o geblock.o btree.o
here.o \
      cbkeycmp.o node.o blockio.o bufpool.o member.o

cbinit.o: cbinit.c $(HEADERS)
   $(CC) $(FLAGS)  cbinit.c
```

```
cbcreate.o: cbcreate.c $(HEADERS)
   $(CC) $(FLAGS) cbcreate.c

cbcurr.o: cbcurr.c $(HEADERS)
   $(CC) $(FLAGS) cbcurr.c

cbexit.o: cbexit.c $(HEADERS)
   $(CC) $(FLAGS) cbexit.c

cbclose.o: cbclose.c $(HEADERS)
   $(CC) $(FLAGS) cbclose.c

cbfind.o: cbfind.c $(HEADERS)
   $(CC) $(FLAGS) cbfind.c

cbfindit.o: cbfindit.c $(HEADERS)
   $(CC) $(FLAGS) cbfindit.c

cbflush.o: cbflush.c $(HEADERS)
   $(CC) $(FLAGS) cbflush.c

cbfndmrk.o: cbfndmrk.c $(HEADERS)
   $(CC) $(FLAGS) cbfndmrk.c

cbhead.o: cbhead.c $(HEADERS)
   $(CC) $(FLAGS) cbhead.c

cbkey.o: cbkey.c $(HEADERS)
   $(CC) $(FLAGS) cbkey.c

cbdepth.o: cbdepth.c $(HEADERS)
   $(CC) $(FLAGS) cbdepth.c

cbkeylen.o: cbkeylen.c $(HEADERS)
   $(CC) $(FLAGS) cbkeylen.c

cbmark.o: cbmark.c $(HEADERS)
   $(CC) $(FLAGS) cbmark.c

cbmodify.o: cbmodify.c $(HEADERS)
   $(CC) $(FLAGS) cbmodify.c

cbdelete.o: cbdelete.c $(HEADERS)
   $(CC) $(FLAGS) cbdelete.c

cbnext.o: cbnext.c $(HEADERS)
   $(CC) $(FLAGS) cbnext.c

cbopen.o: cbopen.c $(HEADERS)
   $(CC) $(FLAGS) cbopen.c

cbprev.o: cbprev.c $(HEADERS)
   $(CC) $(FLAGS) cbprev.c

cbprterr.o: cbprterr.c $(HEADERS)
   $(CC) $(FLAGS) cbprterr.c

cbconmsg.o: cbconmsg.c $(HEADERS)
   $(CC) $(FLAGS) cbconmsg.c

cberrmsg.o: cberrmsg.c $(HEADERS)
   $(CC) $(FLAGS) cberrmsg.c

cbfcnmsg.o: cbfcnmsg.c $(HEADERS)
   $(CC) $(FLAGS) cbfcnmsg.c

cbtail.o: cbtail.c $(HEADERS)
```



```
   $(CC) $(FLAGS) cbtail.c

curitem.o: curitem.c $(HEADERS)
   $(CC) $(FLAGS) curitem.c

locleaf.o: locleaf.c $(HEADERS)
   $(CC) $(FLAGS) locleaf.c

posnext.o: posnext.c $(HEADERS)
   $(CC) $(FLAGS) posnext.c

posfirst.o: posfirst.c $(HEADERS)
   $(CC) $(FLAGS) posfirst.c

posprev.o: posprev.c $(HEADERS)
   $(CC) $(FLAGS) posprev.c

poslast.o: poslast.c $(HEADERS)
   $(CC) $(FLAGS) poslast.c

cbinsert.o: cbinsert.c $(HEADERS)
   $(CC) $(FLAGS) cbinsert.c

root.o: root.c $(HEADERS)
   $(CC) $(FLAGS) root.c

keyvalid.o: keyvalid.c $(HEADERS)
   $(CC) $(FLAGS) keyvalid.c

makefit.o: makefit.c $(HEADERS)
   $(CC) $(FLAGS) makefit.c
```

```
offleft.o: offleft.c $(HEADERS)
    $(CC) $(FLAGS) offleft.c

offright.o: offright.c $(HEADERS)
    $(CC) $(FLAGS) offright.c

insnode.o: insnode.c $(HEADERS)
    $(CC) $(FLAGS) insnode.c

delnode.o: delnode.c $(HEADERS)
    $(CC) $(FLAGS) delnode.c

joinnode.o: joinnode.c $(HEADERS)
    $(CC) $(FLAGS) joinnode.c

cbblksiz.o: cbblksiz.c $(HEADERS)
    $(CC) $(FLAGS) cbblksiz.c

ctlrec.o: ctlrec.c $(HEADERS)
    $(CC) $(FLAGS) ctlrec.c

movekey.o: movekey.c $(HEADERS)
    $(CC) $(FLAGS) movekey.c

space.o: space.c $(HEADERS)
    $(CC) $(FLAGS) space.c

geblock.o: geblock.c $(HEADERS)
    $(CC) $(FLAGS) geblock.c

btree.o: btree.c $(HEADERS)
    $(CC) $(FLAGS) btree.c

here.o: here.c $(HEADERS)
    $(CC) $(FLAGS) here.c

cbkeycmp.o: cbkeycmp.c $(HEADERS)
    $(CC) $(FLAGS) cbkeycmp.c

node.o: node.c $(HEADERS)
    $(CC) $(FLAGS) node.c

blockio.o: blockio.c $(HEADERS)
    $(CC) $(FLAGS) blockio.c

bufpool.o: bufpool.c $(HEADERS)
    $(CC) $(FLAGS) bufpool.c

member.o: member.c $(HEADERS)
    $(CC) $(FLAGS) member.c
```

Listing 2

```
* Listing Two.  LMK file for building
the ISAM library
# John Bushakra    06/10/91
#


# Removed path.c, getdisk.c, and getcurdr.c
for AMIGA conversion
#
CC=lc
FLAGS=-Rlib:isam.lib
LIB=LIB:isam.lib
HEADERS= isam.i isam.h isamerr.h isam.cfg \
        dh0:lc/source/cbt/cbtree.h dh0:lc/
source/cbt/member.h

$(LIB):  isaminit.o isamexit.o copydb.o
newindex.o destrydb.o \
        renamedb.o dbhandle.o findrec.o
findtail.o getfldct.o \
        getidxnm.o isammsg.o prterr.o
matchkey.o modrec.o \
        rmindex.o delrec.o holes.o
showkey.o addrec.o \
        createdb.o findkey.o findprev.o
mkindex.o namelist.o \
        progress.o ihandle.o showdb.o
findmark.o findnext.o \
        findhead.o getrec.o getrlen.o
markrec.o matpre.o \
        showdesc.o getdesc.o showfld.o
getfldnm.o showidx.o \
        showrec.o upindex.o mkkey.o
opendb.o closedb.o \
        filename.o chgextnt.o flushdb.o

isaminit.o: isaminit.c $(HEADERS)
    $(CC) $(FLAGS)  isaminit.c

isamexit.o: isamexit.c $(HEADERS)
    $(CC) $(FLAGS)    isamexit.c

copydb.o: copydb.c $(HEADERS)
    $(CC) $(FLAGS)    copydb.c

newindex.o: newindex.c $(HEADERS)
    $(CC) $(FLAGS)    newindex.c
```

```
destrydb.o: destrydb.c $(HEADERS)
    $(CC) $(FLAGS)    destrydb.c

renamedb.o: renamedb.c $(HEADERS)
    $(CC) $(FLAGS)    renamedb.c

dbhandle.o: dbhandle.c $(HEADERS)
    $(CC) $(FLAGS)    dbhandle.c

findrec.o: findrec.c $(HEADERS)
    $(CC) $(FLAGS)    findrec.c

findtail.o: findtail.c $(HEADERS)
    $(CC) $(FLAGS)    findtail.c

getfldct.o: getfldct.c $(HEADERS)
    $(CC) $(FLAGS)    getfldct.c

getidxnm.o: getidxnm.c $(HEADERS)
    $(CC) $(FLAGS)    getidxnm.c

isammsg.o: isammsg.c $(HEADERS)
    $(CC) $(FLAGS)    isammsg.c

prterr.o: prterr.c $(HEADERS)
    $(CC) $(FLAGS)    prterr.c

matchkey.o: matchkey.c $(HEADERS)
    $(CC) $(FLAGS)    matchkey.c

modrec.o: modrec.c $(HEADERS)
    $(CC) $(FLAGS)    modrec.c

rmindex.o: rmindex.c $(HEADERS)
    $(CC) $(FLAGS)    rmindex.c

delrec.o: delrec.c $(HEADERS)
    $(CC) $(FLAGS)    delrec.c

holes.o: holes.c $(HEADERS)
    $(CC) $(FLAGS)    holes.c

showkey.o: showkey.c $(HEADERS)
    $(CC) $(FLAGS)    showkey.c

addrec.o: addrec.c $(HEADERS)
    $(CC) $(FLAGS)    addrec.c

createdb.o: createdb.c $(HEADERS)
    $(CC) $(FLAGS)    createdb.c

findkey.o: findkey.c $(HEADERS)
    $(CC) $(FLAGS)    findkey.c

findprev.o: findprev.c $(HEADERS)
    $(CC) $(FLAGS)    findprev.c

mkindex.o: mkindex.c $(HEADERS)
    $(CC) $(FLAGS)    mkindex.c

namelist.o: namelist.c $(HEADERS)
    $(CC) $(FLAGS)    namelist.c

progress.o: progress.c $(HEADERS)
    $(CC) $(FLAGS)    progress.c

ihandle.o: ihandle.c $(HEADERS)
    $(CC) $(FLAGS)    ihandle.c

showdb.o: showdb.c $(HEADERS)
    $(CC) $(FLAGS)    showdb.c

findmark.o: findmark.c $(HEADERS)
    $(CC) $(FLAGS)    findmark.c

findnext.o: findnext.c $(HEADERS)
    $(CC) $(FLAGS)    findnext.c

findhead.o: findhead.c $(HEADERS)
    $(CC) $(FLAGS)    findhead.c

getrec.o: getrec.c $(HEADERS)
    $(CC) $(FLAGS)    getrec.c

getrlen.o: getrlen.c $(HEADERS)
    $(CC) $(FLAGS)    getrlen.c

markrec.o: markrec.c $(HEADERS)
    $(CC) $(FLAGS)    markrec.c

matpre.o: matpre.c $(HEADERS)
    $(CC) $(FLAGS)    matpre.c

showdesc.o: showdesc.c $(HEADERS)
    $(CC) $(FLAGS)    showdesc.c

getdesc.o: getdesc.c $(HEADERS)
    $(CC) $(FLAGS)    getdesc.c

showfld.o: showfld.c $(HEADERS)
    $(CC) $(FLAGS)    showfld.c

getfldnm.o: getfldnm.c $(HEADERS)
    $(CC) $(FLAGS)    getfldnm.c

showidx.o: showidx.c $(HEADERS)
    $(CC) $(FLAGS)    showidx.c
```

(continued on page 71)

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Wrapped Up with True BASIC

by Roy M. Nuzzo

This article will, as a minimum, show you how to do a graphic word wrap and graphic-oriented text with full justification in code easily translated to any language. It uses True BASIC. This snippet of code is just an introduction. It is part of a much bigger and more serious application which can be further revealed if there is sufficient interest.

I am a heuristic style programmer who has passed from punch card Fortran in the early 60's to PCP11 front panel programming to mainframe multitasking Fortran - assembly and various Pascals on to 'C'. I was always of the 'First, Program in English' school. I have known many super programmers who were testing ideas for applications in Applesoft, or something like it, like me, behind closed doors. I have found that for idea development speed and power and porting, nothing, except English, beats True BASIC. Code that runs on my Tandy lap top or on a Mac, runs on the Amiga without any modification. This especially includes my heavily graphic oriented programs.

True BASIC code is inherently easy to translate. I set up my Manx 'C' source level debugger with a True BASIC window to test ideas on the fly, and use it as my 'C' text editor. It is a highly structured modular and compiled language. It is fast in execution. You may write subroutines in assembly or in 'C' and just use the True BASIC as a front end. You can also use any system call from within True BASIC that might be called in 'C' such as:

```
StringBufPtr = AllocRemember(RememberPtr, BufferSize, MEMKIND)

with minimal change:

let StringBufPtr = AllocRemember(RememberPtr, BufferSize, MEMKIND)
```

The NOLET option removes even this slight difference, but the let statement has many advantages in readability and locating assignments, so I avoid the 'NOLET' option.

There is no speed penalty for system calls done this way. You could learn 'C' like intuition programming from within True BASIC without ever having a 'C' compiler. In fact, I have found it easier to use system functions from True BASIC than from 'C'. There is no speed loss.

Platforms

The original Amiga offering of True BASIC works on Amiga 500, 1000, and 2000+ series under DOS 1.3 or 2.0+, all of which I have used. The originally marketed version does not work with 32-bit architecture as was the case with many products compiled for the original Amiga architecture specs. The 32-bit version, which I am currently using works on all Amigas (I have 6 different configurations covering all the above. It is being called a 'student version'. Why? Beats me. It is a complete and vastly expanded implementation of True BASIC. There is more in this 'student version' than in any language that I have seen. The only missing element is the 'Binder' better known as linker which allows you to tweak your written program to stand alone and not require the language system to run it. But that was always an independent offering.

The new version supports static array and subroutine memory, scripts, preloading compiled work code and many other nifty things to thoroughly spoil a programmer. Some of the code to be used in this series was written and tested on a Tandy lap top and tested under MSDOS even though it was written to be implemented on an Amiga.

Although the language is consistent across platforms, it does an excellent job at getting at details specific to the machine via the Toolkit (support of machine specific functions and libraries such as exec, diskfontlib, intuition etc.). That power is demonstrated in this particular project.

Game Plan

Here is the overall idea: Take nearly any kind of image and put it into a window, in any quadrant, with text, from any text file, word wrapping around it.

The pop-up window can be any legal size, the text can be, thanks to Paul Castonguay (who wrote a nice DiskFont library), shown in any font (including proportional) and be of any spacing and leading. The screen can be of any resolution and mode kind including EHB and, especially, HAM. Text should auto justify and auto hyphenate, when you want it to, and do so on the fly. Text should always be easily read regardless of the current color palette and particularly when running in HAM mode.

You should be able to defeat flicker, even when in interlace mode with 3-D glasses. Regardless of screen resolution, single or ANIM images must also allow true 3-D presentation (XSpecs) taken from live or computer generated sources. 3-D images ought to be showable on or alongside other non 3-D images and in normal program screens used for other program output. 3-D images ought to allow ANIMation and data query.

Text must scroll, with key press, forward and backward. The images, if they are ANIMs, must allow keyboard activation of animation, as well as stepwise single image advance or backup, independent of the text scrolling. User interaction with text or imagery must be handled. For example, a user ought to be able to step through

How to do a graphic word wrap and graphic-oriented, full text justification with True BASIC code

an ANIM (taken from video, say) and stop on any frame and point to anything in that frame to ask what it is or identify it in response to a text question. The image carries data that identifies that point and click for what it is.

The images, themselves, must be able to contain information which is pertinent to what they show (If you show a duck you might want to encode how much it weighs or how loud it quacks without an additional text file. A geographic map image ought to be able to carry the fact that Texas is color 4 and New Jersey is color 6 etc.).

User display programs ought to be able to query images for more than what is displayed. Labels to details seen in the images ought to be able to be shown and disappear independent of the user programming, and be accurately placed regardless of where, on screen, the image is shown. All frames of an ANIMation ought to be able carry hidden information about what is shown.

All of this ability ought to be available to a basic program as:

1. Load an image.
2. Ask the image what text file it wants, if any.
3. Load the text file (any size).
4. Ask the text file if there are there questions to be asked?
5. Present image and text in a pop-up window that does its own screen repair.
6. If the text asked questions, check the user answers against the correct ones which are stored invisibly within the text or within the image.
7. Tell the user the correct answers and score. Repair the screen.

Do all of this in under 15 program lines of code.

The last part first. You put all your programming power into compiled libraries, not programs. Each sub and definition ought to stand alone for its functionality. Doing so, simple single-line calls do complex things. A later improvement within a single library subroutine will be reflected in every program ever written by you that references that library. If I find a better way to hyphenate, every program which calls for hyphenation will be improved, including programs which I have forgotten about.

A good rule, if you are having a hard time deciding what to name a sub, chances are that it is a faulty sub. It should do one thing, making the name obvious. If you are tempted to place the word 'AND' in a subroutine name then split the sub.

We begin with a library to wrap text around brush images stored in array form. The source code to ABrushTextWrapLib is included on disk along with a detailed documentation file ABrushTextWrapLib.DOC. There are, in this library, 21 main subroutines and 5 definitions which do most of the work mentioned above (and other things).

Most? Well, ABrushTextWrapLib calls more essential functions from 3 other libs. Two are the familiar (to system programmers) 'amiga' and 'exec' libs and one is my own 'ScreenModeLib' (which handles extended screen mode switching and array-brush structure). These 3 libraries, called by my library, in turn call 4 more primitive libraries for deep and dirty primordial ooze functionality.

A few things about True BASIC:

Example: a simple function in this library, PolarCharWidth, returns the width of a character in current screen terms. Because you can designate the left, right, bottom, and top window boundaries to be anything in True BASIC (left edge can be minus pi and right edge can be Avogadro's number) you want to know the width of a printed character in terms of the current user declared screen dimensions. You declare the values of the screen edges and ask the system to tell you the number of characters that fit the entire screen independent of that. Divide to get a single character width. That width can be negative or positive depending on whether you set the window boundaries with the positive direction going rightward or leftward.

A very nice feature of this flexible window size value is that you can zoom images without changing the data. Why recalculate the values of 1000 points for x,y, & z when you can just change the values of the window edges? Four numbers, or easier yet:

```
Set Window  WLeft * Zoom, WRight * Zoom, WBot * Zoom, WTop * Zoom
```

The space you allow for text and the amount of text you wish to show in that space, often conflict. You now apply some rules. If there is extra room to the right of the text, do we pad pixels to spread text and fill it? Well only if it doesn't stretch too few words over too much area. Apply a filter that pleases the eye. Filter? Any set of test rules which please by limiting an otherwise rigid rule. Such as 'not if only two words' or 'not if text takes up less than 75% of the space' etc. Anything you like.

A step into heuristic programming

If the text on a given line would extend too far and exceed the allotted space, break off a part that does fit. It is best is to break sentences at spaces. Hyphenation is trickier because it defies simple rules by way of numerous exceptions. I'm no linguist. I took the heuristic approach. Do tons of it by hand and TABULATE how breaks

actually split words. Group the results into as few categories as will cover the bulk of cases and make a lookup table to reflect this empiric result. Nice. You do not need to understand a phenomenon to deal with it. Just keep score. This is not cheating. This is life. We live and breathe by observation and correlation.

Here is my fast (just the most common splits) hyphenation scheme:

Separate spans of letters of four sizes by nontext control code separators shown here as '^'.

1: "ING^^^OID^^^TIO^^^NES^^^MEN^^^LIN^^^TAG" SIZE 3
2: " SUB PRE NON
DIS^^^TRAN^^^OVER^^^NDER^^^UPER^^^POST" SIZE 4
3: "BKMNRWZHCFDTPJLVXY" with any two letters preceding SIZE 1 of 2
4: "GKMPQWRJCVDTSL" with any two letters following 2 of 2

Start looking from the right side of the line beginning at the point at which it exceeds the available space.

Oh by the way

An aside, about strings. True BASIC string handling is furiously fast. The form is familiar to 'C' programmers who use pointers:

Letters in a string are numbered from 1 to whatever, no limit. Zero precedes the first letter and MAXNUM means after the last (a built-in value equal to the largest number that the current machine can handle in hardware).

String$[J:K] means the text from character position number J to position number K.
"ABCDEFGHIJKL"[3:5] means "CDE"
"ABCDEFG"[0:MAXNUM] = "ABCDEFG" as does
"ABCDEFG"[0:1000] , any number too large grabs up to the last character.

Given that S$ = "ABCDE", let S$[0:0] = "123" produces S$ = "123ABCDE".
Further, let S$[MAXNUM:0] = "789" now produces S$ = "123ABCDE789".
Yet further, let S$[4:7] = "" results in "123E789".

To check for a three letter sequence "ABC" in a string S$ from the right:

```
        for J = len(S$) to 3 step -1
    if pos( s$[J-2:J],"ABC" )   > 0 then
       call Say("I found it.")
       exit for
    end if
next J
```

About numbers, do not worry about 'types' of numbers (INTEGER or FLOAT etc.). True BASIC figures them out from context. There are just strings and numbers. Period. Arrays can have any base.

You can have an array of five numbers starting from base -3 going to 1.

```
dim N(-3 to 1) also written as dim N(-3:1)
dim Vec(7) by default is from 1 to 7 unless you had
SET OPTION ZERO in which case it is from 0 to 7.
        for T = LBound(TextArray$) to UBound(TextArray$)
    if UCASE$( TextArray$(T)[1:3] = "REM" then
       call printtext(TextArray$(T), "blue")
    else
       call printtext(TextArray$(T), "black")
    end if
next T
```

Back to hyphenation:

Say the sentence is: "Many have been hurt by inflammatory predesignations about their ...blah blah".

If predesignations only fits as far as predesignatio' then counting backward for three-letter sequences, from group one, finds "TIO" matches as a hyphenation break point. If we simply want to break as far to the right as possible, then this line would hyphenate 'predesigna-' and 'tion ' would start the next line. Some schemes do this rather than first look for a 'close enough' space break. To prevent too many hyphenations, some count how many and disallow hyphenations on successive lines, every third, etc. We will instead declare a larger zone for preferred line chopping and give space chopping first shot even if it is further left than a hyphenation break. Don't like that? Change it. If space chop fails then hyphenation tries. If that fails, the attempt is repeated for both. but further left.

A four letter breakpoint, from group two, lies further to the left " PRE". Even so, a space chop will be used if the initial zone is set so that it reaches the space before 'pre'. Failing that, break between any two letters composed of one from group 3 and the next from group 4.

Recap: Always break at a space if encountered. Test a larger distance from the right for spaces before trying to hyphenate. If there are no spaces up to this first limit point,look for hyphenation breakpoints instead. If that fails, look further yet to the left for spaces, and if failing look more yet for hyphenation. Last resort is to coldly truncate. In all cases one space is allowed for the hyphen.

Therefore, we need two subs to divide a line of text. One by space and one by hyphenation. Both confine themselves to the right sided range passed to them. Both are called by a control sub with increasing ranges of text from the right margin (if line division is not successful).

```
                    / sub SpaceChop(PctLine)
ControlSub<
          \ sub DoHyphen(PctLine)
```

The calling control sub first takes care of any exceptional cases where chopping is not to occur and traps embedded code in the text that requests a line feed or form feed (user request, a yet higher priority).

Using an array of strings to hold various line or form feed sequences allows user designation of personal codes as well as those hard coded into the scheme. The hard coded ones are CHR$(10), CHR$(12), and CHR$(13). They are hard coded by simply priming the array with them. Next year you might consider adding others. Code modularity makes it easy to find where and remember how.

```
sub SetLineFeedArray(LFA$(),TextLF$,TextFF$)
    ! This sub sets up and primes an array to hold
    ! line and form feeds
    ! To alter built in LF of FF everywhere, edit here.
    ! Remember the lower bound of the array is not
    ! limited to zero.
    !-------------------
    mat LFA$ = Nul$(0:5)  ! 1 & 5 = USER, null is ignored.
               let LFA$(0) = "LFFFSET" ! LBOUND Flag to tell sub that
                             ! array is primed.
               ! LINE FEED CODES
    let LFA$(1) = TextLF$  ! USER CHOICE
    let LFA$(2) = CHR$(10)
    let LFA$(3) = CHR$(13)
               ! FORM FEED CODES
    let LFA$(4) = CHR$(12)
    let LFA$(5) = TextFF$  ! USER CHOICE
```

```
end sub

sub ParseText(Source$, TextLF$, TextFF$, NumChars,HyphPct,
              WasLFFF, Fragment$)
    ! To avoid setting up LineFeed Array.
    ! This is a 'front end' to
    ! sub ParseText0()
    dim LFA$(1)
   call SetLineFeedArray(LFA$,TextLF$,TextFF$)
   call ParseText0(Source$,LFA$,NumChars,HyphPct,
                   WasLFFF,Fragment$)
end sub

sub ParseText0(Source$, LFA$() ,NumChars, HyphPct,
               WasLFFF, Fragment$)
    ! This is the main line split control.
    ! It calls for space chops and for hyphenation.
    ! How many letters are allowed at once = NumChars
    ! You send text as Source$ (can be pages) and it
    ! chews off that which fits (returned as Fragment$). It
    ! does not actually print. That offends modularity.
    ! Many kinds of programs may have specific needs
    ! for printing.  One job: split.
    ! The caller to this sub may want to know if
    ! the split was by  way of LF or FF code so as
    ! to handle output to screen.-> WasLFFF
    ! in case an unprimed line feed array is sent,
    ! this is friendly.
              if LFA$(LBound(LFA$)) <> "LFFFSET" then
      call SetLineFeedArray(LFA$,"","")
    end if

              let Fragment$ = ""
    let LS = len(Source$)
    let WasLFFF = 0           ! Flag, user or text imbedded
                              ! LF or FF found.
    let LowestLFpos = MAXNUM  ! Flag, initialize high lim
                              ! Scan line for LF or FF
                              ! breaks and use the most
                              ! left one (lowest).
              ! LOOK FOR A TEXT EMBEDDED LINE OR FORM CHOP
    !-------------------------
    for Marker = LBound(LFA$) +1 to UBound(LFA$)
        if LFA$(Marker) <> "" then
            let LFAtpos = pos(Source$[1:NumChars],
LFA$(Marker))
            if LFAtpos > 0 then
               if LFAtpos < LowestLFpos then
                  let LowestLFpos = LFAtpos
                  let WasLFFF = Marker
               end if
            end if
        end if
    next Marker

    ! IF EMBEDDED LINE CHOP FOUND, HANDLE IT AND EXIT
    !-------------------------
    if WasLFFF > 0 then
     let Fragment$ = Source$[1 : LowestLFpos -1]
     let Source$[1:LowestLFpos +len(LFA$(WasLFFF))-1] = ""
     exit sub
    end if

    ! If text does not exceed space, clean up and leave
    !-------------------------
    if LS <= NumChars or NumChars < 2 or LS < 4 then
      let Fragment$ = Source$
      let Source$ = ""
      exit sub
    end if

    ! Text space is to fill before allowing hyphenation?
    !-------------------------
    if HyphPct < 0 then  ! neg val, set default
       let Hyphenate = .8
    else
       let Hyphenate = min(HyphPct,1)
    end if

    !-------------------------
    ! PULL OFF ANY CODES FOR TEXT NOT TO BE FORMATTED:
    ! This may EXCEED the dimensions for printing as it
    ! is code not to be printed but parsed for program
    ! interpretation and action by the caller subroutine.
    ! The ABrushWrapText subs handle text which might have
    ! an embedded segment ".PROMPT. whatever whatever...\"
    !-------------------------
    if Source$[1:8] = ".PROMPT." then
       ! just one example
       ! Pull Off Full Prompt, of any length
       ! this list can grow
       let endpmt = pos(Source$,"\")
       let Fragment$ = Source$[1:endpmt-1]
       let Source$[0:endpmt] = ""
       exit sub
    end if

    !-------------------------
    ! Make an upper case copy of the source string segment
    ! to the maximum allowed print length only.
    ! Do tests on all upper case for sanity:
    !-------------------------
    let Test$ = UCASE$(Source$[1:NUMCHARS +1])

    !-------------------------
    ! First Pass:
    ! Try space chop at most right portion of line as user
    ! requested. If no space to chop at then
    ! try hyphenation in same
    ! zone. We're calling that zone 'Hyphenate'.
    ! It is for both, here.
    !-------------------------
    call SpaceChop(Hyphenate)
    ! Same range as hyphenation zone
    ! If a chop point was found, the source string will
    ! be smaller and the fragment, to be printed,
    ! will have something in it.
              If Fragment$ = "" and Hyphenate > 0 then
       ! Space chop failed
       call DoHyphen(Hyphenate)
    Else
       exit sub
    End if

    ! IF HERE, ABOVE FAILED. GO MORE LEFTWARD, TRY AGAIN
    !-------------------------
    ! Could loop stepwise to left. I just give the zone one
    ! shot then take a leap to the left (30% from left).
    !  The .3 choice is arbitrary.
    !-------------------------
    If Fragment$ = "" then call SpaceChop(.3) else exit sub
    If Fragment$ = "" then call DoHyphen(.3)  else exit sub
    If Fragment$ = "" then call SpaceChop(0)  else exit sub

    ! GIVE UP, JUST CHOP IT. (but need space for the '-')
    !-------------
    let Fragment$ = Source$[1:numchars-1] & "-"
    let Source$[1:numchars-1] = ""
              sub SpaceChop(PctLine) ! local subsub
        ! pct -> number of chars
        let Term = int(numchars * PctLine) + 1
        for i = numchars to min(Term,numchars) step -1
            if Source$[i:i] = " " then
               ! found a space
               ! note string before the space:
               let Fragment$ = Source$[1:i-1]
                         ! delete it in source
               let Source$[1:i] = ""

               exit for
            end if
        next i
    end sub
             sub DoHyphen(PctLine) ! local subsub
     let Term = int(numchars * PctLine) + 1
     For i = numchars-1 to min(Term,numchars -1) step -1
         let j = i-1
         let PrefSp = pos(Test$[i-3:i]," ") ! 321^
         let PostSp = pos(Test$[i:i+2]," ") ! ^12
                ! THE FOLLOWING CODE IS FORMATTED ODDLY FOR CLARITY:
      ! actual working code is strung out
      !-------------------------
      If
        (
        pos("ING-OID-TIO-NES-MEN-LIN-TAG",Test$[i:i+2]) > 0
         AND   PrefSp = 0
         )
                  OR (
        pos(" SUB PRE NON DIS-TRAN-OVER-NDER-UPER-POST",          Test$[i-
4:j]) > 0
         AND   PostSp = 0
         )
                  OR (
        pos("BKMNRWZHCFDTPJLVXY", Test$[j:j]) > 0
         AND
        pos("GKMPQWRJCVDTSL",Test$[i:i]) > 0
         AND
        (PrefSp + PostSp = 0)
         )
                 Then
```

```
        ! Hyphenate, but first
        ! Handle special orphan and punctuation cases.
        ! This list may grow.
        !------------------
        If Source$[j+2:j+2] = " " then
           ! Rid single char orphans
           let Fragment$ = Source$[1:j+1]
           let Source$[1:j+2] = ""
        else if pos(".,;:?=!",Source$[j+2:j+2]) > 0 then
           ! Rid sentence end clip. Should fit
           let Fragment$ = Source$[1:j+2]
           let Source$[1:j+2] = ""
        else if pos(".,;:?=-!",Source$[j+1:j+1]) > 0 then
             ! Rid punct orphans
             let Fragment$ = Source$[1:j+1]
             let Source$[1:j+1] = ""
        else
           ! Original Algorithm
           let Fragment$ = Source$[1:j] & "-"
           let Source$[1:j] = ""
        end if
                  exit for
     End If
     Next i
  end sub
end sub
```

Now that the line is clipped to fit neatly, you might justify it within the desired print space. You may decide only to allow 10 letters in a space that might be able to hold 13 (margins etc.). Keep clip and justify apart.

```
            !------------------
!*  JUSTIFY TEXT: IN GRAPHIC CONTEXT ----------
!------------------
! Consider:
! *  spacetofill with text. *
! | ------------------------| <- here-> 24 chars
! X- - - -SpaceToFill- - - -X2
           ! Pass
!       X = Left edge and allowed span (SpaceToFill)   or
!       X = Left edge and X2 = right edge              or
!       X = Left edge and Chars to allow on a line.
```

```
! All 3 define the same space.
! Several slave subs allow the main sub to be called according to
! program ease of variable handling.

sub PlotJustifiedFastSp(Strg$,X,Y,YOff, ChW, SpaceToFill,
                        JustPct, Margins)
    ! JustPct: <0 = default (line of 60% text,-> to 100%,
    !              where text means packed nonspace
    !              characters.)
    !           0 = No justification
    !        0><1 = pass % of line text to -> justification
    !         =>1 = Num of end spaces to -> justification
    ! Margins are stated in number of characters
    !          (.5,1,2 etc.) L & R.
    ! YOff generally = 0. If not, text is plotted twice
    ! with this offset
    ! such as 1 pixel to reduce flicker in interlace.
    ! Strg$ the passed string.
    ! Plot text starting at X,Y
    ! Plot it again, maybe, offset vertically by
    ! YOff to kill flicker.
    ! Tell this sub what the Character width is so it need
    ! not refigure over and over if called in a loop.
    ! SpaceToFill = graphic terms, the space avail to print
    ! Margims, as chars
    ! JustPct, ? justify at all or
    ! just when to do it or lie low.
              dim A$(90) ! up to 90 'words' on a line.
              ! A  'word' can be 1 char.
              ! Work with a copy, trim off trailing space.
    let String$ = RTrim$(Strg$)
    let LS = len(String$)
              ! Treat left space as firm.
    ! It is an indent not to be justified.
    let S$ = LTrim$(String$)
              let Indent = (LS - len(S$)) * Chw
    let AChw = abs(Chw) ! Chw can be negative in True BASIC
    let ASpaceToFill = abs(SpaceToFill) ! left can be
                                        ! > than right
              if Margins <> 0 then
       if Margins > 0 then
        ! Clip off margin space first.
        let ASpaceToFill = ASpaceToFill -2 * AChw * Margins
```

To do or not to do—that is the question.

Roy M. Nuzzo

True BASIC has several very off-beat and useful extensions.

1. There are scripts which behave like batch files within the True BASIC command window.

2. There is the extended use of direct command mode which allows use of libraries directly, without need for any programming. This can be used as the ultimate desktop calculator. But how do you keep a written record of it?

3. There is the "ECHO" function which acts as a stenographer for the command window and can divert a copy of all command window text to a file or to the printer. A paper trail.

4. There are "Do Programs" which act in the background and have the ability to look at and react to and/or alter programs currently in the editor or do whatever else a program might be asked to do.

This piece will familiarize you with the last two.

Scripts are just text files of commands as they might be typed directly into the command window. They are acted on as if they were directly typed by you. If you want to keep a record of this beyond the running shell-like list of old actions kept automatically by the command window), then just type "ECHO".

ECHO defaults to the printer. Anything typed or printed to the command window also appears at the printer. "ECHO TO filename" creates a text file which is a file version of the printer output without the printer output. Therefore, if you do a series of commands relating to a complex calculation, all of it is recorded for you.

"ECHO OFF" shuts the echo function off.

Scripts can turn ECHO on and off, as they can perform any command.

"Do programs" are very handy and interesting. Any library can be made to act as a "do program" or better yet be called by a do. The 'do' has only one iron-clad rule: The argument list of the very first sub (must be a sub) must be a single dimension string array followed by a string:

```
    EXTERNAL  ! <— indicates a library without program code to be executed
    sub MyDo(line$(),String$)
  ... code
end sub
    ... other subs  and functions may follow.
```

The 'do' sub, the first one in the library, is activated when the library name is evoked by a 'do' command. If the above library were named 'Glitz', then a command 'do Glitz' would automatically activate the sub MyDo() as a background task. Notice that the sub name is irrelevant. It is simply the first sub and it has the needed two arguments. Typically, you write this sub as if it were a program. The 'end sub' statement is the 'end' statement.

```
    let LM = Chw * Margins  ! set new X to plot text
                            ! at, left margin.
   else
    ! default = 1 char
    let LM = Chw
   end if
end if
let XN = X + Indent + LM
          Select Case JustPct
   case is < 0 ! Use default
     ! let SpToJust = 2 +(.18 * (TotalChars)  )
      let SpToJust = 2 +(.18 * (ASpaceToFill / AChw))
      let Trigger = ASpaceToFill - AChw * SpToJust
            case 0      ! Justify is off. Do as is.
      plot text, at X + LM, Y : String$
      if YOff <> 0 then
         plot text, at  X +LM, Y +YOFF : String$
      end if
      exit sub
            case is => 1 ! # of Chars at end to -> justify
      let Trigger = ASpaceToFill - AChw * JustPct
            case else
     let Trigger = JustPct * ASpaceToFill
End Select
          do
   let p = pos(S$," ")
   let words = words + 1
   if p > 0 then
     ! COLLECT WORDS-> AN ARRAY WITH SPACES TRIMMED
     ! PARSE ON SPACES BETWEEN WORDS
     let A$(words) = Trim$(S$[1:p-1])
     let S$ = Trim$(S$[p+1:MAXNUM])
   else
     let A$(words) = S$
   end if
            ! TALLY TOTAL CHARACTERS MINUS THE SPACE BETWEEN
   ! THIS IS A TOTALLY EYE ORIENTED SCHEME, EMPIRIC
   let NonSpChars = NonSpChars + len(A$(words))
loop while p > 0
          let ACharFill = NonSpChars * AChw  +  abs(Indent)
          if ACharFill => Trigger then
  !-------------------
      ! IF the solid area (nonspace) exceeds the user
      ! requested trigger then go ahead and expand the
      ! space between words, by pixels.
     ! [.....................v--------trigger]
      ! [HimynameisFred.Whatisyourname?                ]
      ! [<-        AcharFill   -*->|<- TotalSpace  ->]
      ! [Hi  my  name  is  Fred.   What  is  your  name?]
      !-------------------
                ! Where TotalSpace is total space to be used up by
      ! word spacing, figure space needed between each
      ! word to expand to right edge. For ease, use the
      ! abseolute val of the print zone length.       !-----------------------
-
      let TotalSpace = ASpaceToFill - ACharFill
                ! Don't justify 2 words, never looks right.
      if words > 2 then
        !-------------------
        ! Set the space polarity to that of the sign of
        ! the char width:
        ! Each space = total space divided by word          ! intervals.
        ! Remember that the interval count between 5
        ! fingers is 4.
        !-------------------          let EachSpace = Sgn(Chw) *
(TotalSpace/(words-1))
      else
        let EachSpace = ChW   ! normal single character
      end if
                !-------------------
      ! Plot one word at a time and add its following
      ! space, then move the left plot point to that spot
      ! and do next word. The first word start is figured
      ! above. Just move it along.
      !-------------------
      for w = 1 to words
          plot text, at XN, Y : A$(w)
          if YOff <> 0 then
            plot text, at XN, Y + YOFF : A$(w)
          end if
                    let XN = XN + len(A$(w)) * ChW +EachSpace
          !   **plotx   **width of word   **width of space
```

(continued on page 74)

When the sub is exited, the editor becomes active once again (it freezes during the action of the 'do' program.

You pass one argument to this sub. If you supply none, then a null is automatically passed. You do not pass anything to the array. This array is supplied by the 'do' mechanism for you. Therefore, if you typed, from the command window, 'do Glitz, "Hello Fred."', then the String$ argument would carry "Hello Fred.". As far as the call is concerned, there is only this one argument, the simple string argument.

That one string can be huge and carry all sorts of numbers and string and character values within it, as True BASIC has very refined tools for loading and unloading complex data from strings. You system programmers will note that strings are used to form 'structures' when they are needed and this means that they can be Window structures, ViewPort structures, you name it structures, whatever.

The line$() array is automatically passed. Its lower limit is always 1, and its upper limit is equal to the number of lines of code currently in the editor. Line$(1) carries the first line of code, Line$(2) the second etc. This is not a copy of the code in the editor, it *is* the code. If you do neat things to this code, you do neat things to the actual program in the editor.

Like what?—like remove or alter remarks, or look for special code within remarks to cause a file to be created (auto docs) that update programming documentation. Or alter spacing and capitalization to fit a standard for style of the code. Or strip CHR$(13) from the code (load text files from IBM to Amiga, you may need to get rid of the extra CHR$(13)s from the IBM world). Or - strip out tab characters and replace each with three spaces (hello 'z' C edit people). Or - use as a preprocessor swapping tokenized code for expanded code. Here, the algorithims for the swap can get as hairy, and as dangerous, as you can stand.

Here are a few examples:

```
! 'Strip_13_Do'
! This file is saved as 'Strip_13_Do' for source file
! but in compiled form as 'Strip13' in the TBDo drawer.
! To use, type 'do Strip13' from the command line or click on it
! from the menu requestor for 'do' files.
! The file in the editor will have all CHR$(13)s removed and the tokens
! that indicate their presence will disappear. Resave if you want.
          EXTERNAL
          SUB Strip13_DO(line$(), arg$) ! will ignore arg$, irrelevant
  declare def Before$, After$, SwapChar$
            for i = 1 to UBound(line$)
     if pos(line$(i),CHR$(13)) > 0 then
       let line$(i) = SwapChar$(line$(i),CHR$(13),"")
     end if
  next i

DEF Before$(s$,w$) ! COPY OF ALL CHARS BEFORE w$
    let p = pos(s$,w$)
    if p = 0 then
      let Before$ = ""
    else
      let Before$ = s$[1:p -1]
    end if
end def

DEF After$(s$,w$) ! COPY OF ALL CHARS AFTER w$
    ! 'MAXNUM' is a True BASIC constant which returns
    ! the largest number that the computer you running
    ! can handle legally. Good upper limit for strings.
              let p = pos(s$,w$)
    let l = len(w$)
    if p = 0 then
      let After$ = "" else let After$ = s$[p+1:Maxnum]
    end if
end def
```

(continued on page 74)

Assembly Language & Computer Simulations

by Bill Nee

Using the Amiga 500 and now my newly acquired Amiga 3000 for computer simulations is one of my favorite pastimes. The speed at which these machines run, coupled with 32 colors, make for very interesting displays. And with the computer you can easily change values to see what effect new parameters have. In this article we'll do a simulation showing how a virus can spread between cells. Values to be used will be passed from CLI/SHELL with the program name, and I'll show you yet another PSET routine.

The Simulation

The simulation we're using was first described by A. K. Dewdney in *Scientific American* (8, 1988). An array is filled with cells on a random basis with values from 0 to 50. Based on the relationships described below, new cell values are computed, stored in a second array, then transferred back to the first array. Cells in the first array are colored according to a color scheme within the program.

Each cell is considered to be in one of three states depending on its value. A cell with a value of 0 is HEALTHY, a cell with a value between 1 and 49 is ILL, and a cell with a value of 50 is DEAD. A dead cell will become a healthy cell at the next generation. That's the easy one. To discuss the next two states we need to learn a few variables:

AA - number of ill cells, not less than 1
BB - number of dead cells
K1 - a weighting parameter (2 is the default value)
K2 - a weighting parameter (3 is the default value)
GG - the infection constant (use 1-20; 6 is the default value)
S - sum of a cell's value plus its four neighbor values

The formula for the next generation of a healthy cell (value 0) is INT(AA/K1)+INT(BB/K2). Generally, keep K1 and K2 between 1 and 4; of course, don't let one of them ever be 0! The formula for the next generation of an ill cell is INT(S/AA)+GG; if this value, however, exceeds 50 the new value will be 50. The program will wrap-around so the right neighbor of a cell on the right side is actually the cell on the left side and vice-versa; the same applies to the top and bottom. With these three rules you can create patterns of continuously changing color; some never settle down while others become ever growing spirals.

Listing 1 is the program for this simulation. Since the test of each cell and the computation of the next generation cell is the most important routine, I made this a macro near the start of the program. You could have it as a subroutine instead, but then the current program address must be saved each time and returned; since we've got the space, I used it as a macro. Because TEST is the heart of the program, I'll go through it in detail.

The Macro

The four values passed to TEST are the locations of each of the four neighbors (above, left, right, and below) in relation to the current cell; the value of the current cell is in d0. Since MOVE affects the zero flag we can check right away and see if the current value is 0; if so, branch to HEALTHY. If it's not 0, compare the value to 50; if it's not equal, branch to ILL. The only choice left is that the value must be 50, so store the next generation's cell value of 0 in d0 and branch to TESTDONE.

If a cell is HEALTHY, first put a 1 in AA (its value is never less then 1) and a 0 in BB. Next, move a neighbor's cell value into d1. If this value is 0, go immediately to the next neighbor check since a zero won't affect anything. However, if the neighbor's cell value is 50, increase BB by 1, else increase AA by 1. After all four neighbors have been checked, divide AA by K1 and BB by K2 then add AA and BB. This new value will be the cell value for the next generation.

The final test is for an ILL cell. Again, put a 1 in AA; we won't be using BB this time. Get a neighbor's cell value in d1. If it's 0, branch to the next neighbor check; if not, add the neighbor's cell value to the current cell value. If the neighbor's cell value is 50, branch to the next neighbor check, else increase AA by 1. Go through all four neighbors in the same manner. When you've finished, d0 contains the neighborhood's sum and AA is the number of all ill cells, then divide d0 by AA. Here's where you have to have planned ahead.

I kept the maximum cell value at 50 since, at this point, the neighborhood's sum in d0 could be 49+4*50 or 249. While you could squeak by using 51, larger maximum values could result in a d0 value greater than one byte. Next you would add GG to the division result and compare the total to 50. But if the result in d0 was, for example, 245 and you added a GG of 15 the byte value in d0 would be 5 and this would appear to be less than 50 when it's actually 260. So I first check the division result against the difference between 50 and GG. If it's greater than this, adding GG will make the result greater than 50 so put 50 in d0 as the next generation's cell value. If the value is not greater than the difference you can safely add GG and use this as the new next generation's cell value.

The Listing

Now let's look at Listing 1 in more detail. Since they're used so often, I equated AA and BB to registers d3 and d4 as well as equating SUM, ACROSS, and DOWN to their registers. The length of the array must be a multiple of 32; more about that later when I discuss the new PSET routine. Several variables are equated to the length (LENM1, LEMP1, etc.) as well as the size of the array needed. I'll explain the other variables when we get to PSET. Next, there are several macros as well as the TEST macro.

The program starts in standard fashion opening the Intuition and Graphics libraries as well as a 320x200 16-color screen and window.

→

TABLE I

K1	K2	GG	K1	K2	GG	K1	K2	GG
1	4	6	2	2	10	3	1	7
1	3	5	1	1	5	4	1	3
3	1	15	1	1	10	2	3	6

The RANDOM routine uses the CIA register to fill Array1 with random values between 0 and 50. The next part of the program reads the values you passed, if any, along with the program name. Enter values for K1, K2, and GG separated by a space or comma; for example, 'SICKWELL 2 3 6' or 'SICKWELL 3,2,18'. If you don't enter any values the program will default to 2,3,5 respectively.

When you enter values in this way at the start of the program a0 contains the location of these values and d0 contains the number of characters entered. The first two values must be one digit each while the last value could be one or two digits. I haven't included any checks for incorrect values; I'll leave that up to you. You might also want to add a routine allowing for a "?" instead of a value and then have a message printed reminding you of what's to be entered along with the acceptable ranges.

Now the program must check every cell to compute its next generation value. To accomplish the wrap-around there is a separate routine for each of the four corners, top row, bottom row, sides, and center square. If you use a length of 32*5 or 160 the top row actually goes from 0 to 159; the next cell in the array is 160. The four neighbors of the upper-left cell (cell 0) are located at LEN*LENM1, LENM1, 1, and LEN (top, left, right, and bottom) away from cell 0. The neighbors for the top row are LEN*LENM1, -1, +1, and LEN away from each cell. The neighbors for the upper-right cell (cell LENM1) are LEN*LENM1, -1, -LENM1, and LEN. For the center square starting at cell LENP1 the four neighbors are -LEN, -1, +1, and LEN away. It may be easier to draw a box, divide it into smaller squares and label some of the cells to see the relationship. Just remember that the upper-right square is LENM1.

Another PSET Routine

When all of the new cell values are in Array2, it's time to transfer them back to Array1 and PSET them. I said that I'd discuss another PSET routine so here goes. This routine is based on the "Fast Fractals" article in *Amazing Computing* (V 4, 11) and a program sent to me by Stan Jurgielewicz of Virginia. Stan is a real renaissance man and an expert at just about everything. He doesn't hesitate to rewrite my programs in five different ways showing me better methods to do everything.

This routine fills data registers with 32 values at a time and actually pokes them into the proper screen locations. That's why the arrays must be multiples of 32 across. Different data registers are used to hold each of the four bits that make up each color. Since the bitplanes are an equal distance apart ($1F40 bytes) we only need the location of the first one. SUM contains the current color. Rotating it to the right moves the first color bit into the X bit of the status register; rotating a data register with X carry (ROXL.L) brings the same bit into the data register. If there are four color bits, you must use four data registers. Do this 32 times and each of the four data registers contains one long word of the color value for one bitplane.

Now we have to poke these words into a screen location so we can see them, but where? When we PSET the random values each point was at an XOFF ((320-LEN)/2) and YOFF ((200-LEN)/2) to center the picture. So let's compute the byte that contains these two offsets. There are 40 bytes in each horizontal line (320/8), so the first byte in the row we want is YOFF*40. The XOFF is how many more bits in we go, and since there are 8 bits per byte, divide the XOFF by 8. Add the two values together and that's the start of the byte we need. I defined this at the start of the program using BYTE EQU (YOFF*320+XOFF)/8. To access this location put bitplane1 address in a1 and offset it by byte (LEA BYTE(A1),A1).

To get the color, MOVE the entire first bit register into a1, the second bit register into a1+$1F40, the third bit register into a1+$1F40*2, etc. Actually, do this in reverse so you can end with "(A1)+", automatically increasing a1 by a long word. How many times do you do this across? I use the variable WPL (long Words Per Line) which is just LEN/32. This is the number of times we'll poke color into the screen location going across.

When you finish a line, where is the next byte? A full-screen display would continue on with the next byte but we need to move enough to reach the end of the screen and go on to the next row's X offset. This distance is 2*XOFF in bits, or 2*XOFF/8 bytes; I call this variable BYTEOFF. Using these variables and always making the length a multiple of 32 lets you automatically display different size arrays without re-computing all of the variables. Keep the length at 5*32 or smaller. You must re-assemble the program to change the length.

Since state zero is so important for cells in the array it gets its own color; any other state value is divided by four and increased by one to get its color. I wrote this program on an Amiga 500 having it switch array values before showing the new color. This cuts down on the slight flicker as the new colors are PSET. For faster computers you can eliminate the SWITCH routine and combine it with the new color PSET routine. The program keeps running until you press the LMB. After typing in this program save it as SICKWELL.ASM; assemble it with A68K and BLINK it using SICKWELL.O. Run the program as SICKWELL [K1 K2 GG]. For your convenience, I've included A68K, BLINK, their docs and the assembled version of SICKWELL on the magazine disk.

Table I is a list of some interesting combinations for K1, K2, and GG. Try your own combinations; running the same combination several times in a row may produce different results each time due to the random distribution of initial values.

Listing

```
;LISTING1
equates:
depth          = $4
jam2           = $1
mousebuttons   = $8
borderless     = $800
ww.screen      = $2e
ww.rport       = $32
nw.screen      = $1e
customscreen   = $f
activate       = $1000
rmb            = $10000
public         = $1
chip           = $2
fast           = $4
clear          = $10000
```

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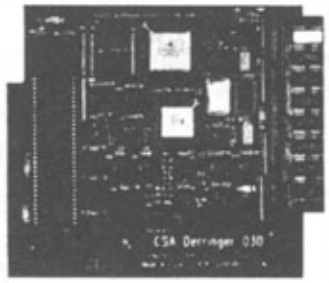

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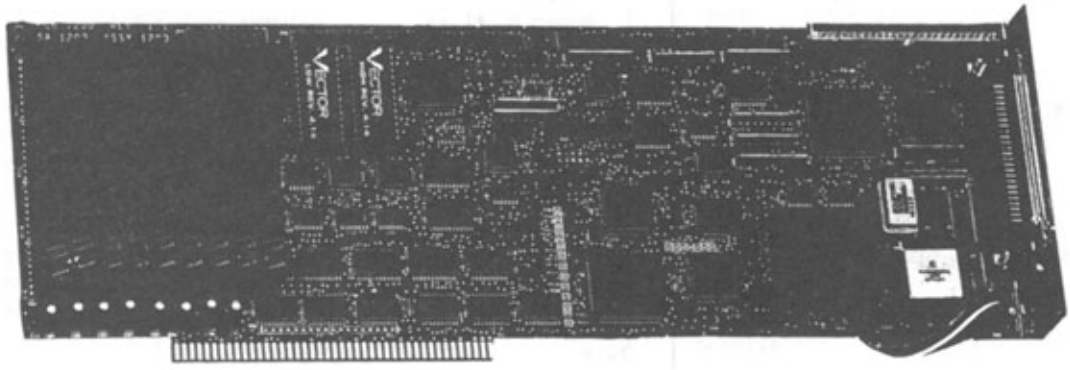

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```
offsets:
;exec
openlibrary   = -552
closelibrary  = -414
allocmem      = -198
freemem       = -210
forbid        = -132     ;no registers used
permit        = -138     ;no registers used
;intuition
openscreen    = -198
closescreen   = -66
openwindow    = -204
closewindow   = -72
viewportaddress = -300  ;a0=window
;graphics
setdrmd       = -354
loadrgb4      = -192    ;a0=vp,a1=colortable,d0=#pens
setapen       = -342
writepixel    = -324

sum     equr  d7
across  equr  d6
down    equr  d5
bb      equr  d4
aa      equr  d3
len   = 32*5
lenm1 = len-1
mlenm1  = -1*lenm1
lenm2 = len-2
xoff  = (320-len)/2     ;to center display
yoff  = (200-len)/2     ;to center display
lenp1 = len+1
lenm3 = len-3
mlen  = -1*len
byte = (yoff*320+xoff)/8 ;byte containing yoff/xoff
wpl   = len/32-1        ;long words per line
byteoff = 2*xoff/8      ;offset to next byte
size  = len*len         ;array size
;k1    equ   2          ;default
;k2    equ   3          ;default
;gg    equ   5          ;default

macros:
syslib  macro           ;(routine)
  movea.l  4,a6
   jsr     \1(a6)
   endm

openlib macro           ;(name,location,BEQ if 0)
   lea     \1,a1
   moveq   #0,d0
   syslib  openlibrary
   move.l  d0,\2
   beq     \3
   endm

intlib  macro           ;(routine)
  movea.l  intbase,a6
   jsr     \1(a6)
   endm

openscreen macro        ;(parameters,screen,BEQ=0)
   lea     \1,a0
   intlib  openscreen
   move.l  d0,\2
   beq     \3
   endm

openwindow macro        ;(parameters,window,BEQ=0)
   lea     \1,a0
  move.l  screen,nw.screen(a0)
   intlib  openwindow
   move.l  d0,\2
   beq     \3
   endm

gfxlib  macro           ;(routine)
  movea.l gfxbase,a6
   jsr     \1(a6)
   endm

test  macro             ;(top,left,right,bottom)
   beq.s   healthy\@
   cmpi.b  #50,d0
   bcs.s   ill\@        ;branch if lower
   moveq   #0,d0
   bra     testdone\@
healthy\@
   moveq.b  #1,aa       ;always at least 1
   moveq.b  #0,bb       ;start bb at 0
h1\@
   move.b  \1(a4),d1    ;cell 'above' value
   beq.s   h2\@         ;branch if 0
   cmpi.b  #50,d1       ;is it 50?
   beq.s   h1a\@
   addq.b  #1,aa        ;if not, increase aa
   bra.s   h2\@
h1a\@
   addq.b  #1,bb        ;increase bb
h2\@
   move.b  \2(a4),d1    ;'left' neighbor value
   beq.s   h3\@
   cmpi.b  #50,d1
   beq.s   h2a\@
   addq.b  #1,aa
   bra.s   h3\@
h2a\@
   addq.b  #1,bb
h3\@
   move.b  \3(a4),d1    ;'right' neighbor value
   beq.s   h4\@
   cmpi.b  #50,d1
   beq.s   h3a\@
```

```
  addq.b  #1,aa
  bra.s   h4\@
h3a\@
  addq.b  #1,bb
h4\@
  move.b  \4(a4),d1     ;'bottom' neighbor value
  beq.s   h5\@
  cmpi.b  #50,d1
  beq.s   h4a\@
  addq.b  #1,aa
  bra.s   h5\@
h4a\@
  addq.b  #1,bb
h5\@
  moveq   #0,d1
  move.b  k1,d1
  divu    d1,aa         ;aa=aa/k1
  moveq   #0,d1
  move.b  k2,d1
  divu    d1,bb         ;bb=bb/k2
  add.b   bb,aa         ;aa=aa+bb
  move.b  aa,d0         ;new generation value
  bra.s   testdone\@
i11\@
  moveq.b #1,aa         ;aa always at least 1
  move.b  \1(a4),d1     ;'top' neighbor value
  beq.s   i112\@        ;branch if 0
  add.b   d1,d0         ;add it to current value
  cmpi.b  #50,d1        ;is it50?
  beq.s   i112\@
  addq.b  #1,aa         ;increase aa by 1
i112\@
  move.b  \2(a4),d1
  beq.s   i113\@
  add.b   d1,d0
  cmpi.b  #50,d1
  beq.s   i113\@
  addq.b  #1,aa
i113\@
  move.b  \3(a4),d1
  beq.s   i114\@
  add.b   d1,d0
  cmpi.b  #50,d1
  beq.s   i114\@
  addq.b  #1,aa
i114\@
  move.b  \4(a4),d1
  beq.s   i115\@
  add.b   d1,d0
  cmpi.b  #50,d1
  beq.s   i115\@
  addq.b  #1,aa
i115\@
  divu    aa,d0         ;total values/aa
  cmp.b   diff,d0       ;greater than 50-gg?
  bgt.s   i116\@
  add.b   gg,d0         ;ok to add gg
  bra.s   testdone\@
i116\@
  moveq.b #50,d0        ;can't exceed 50
  bra.s   testdone\@
dead\@
  moveq   #0,d0         ;dead cell becomes healthy
testdone\@
  move.b  d0,(a5)+      ;save new value;increase array
  endm

pset macro
     move.l   rp,a1
     move.w   across,d0
     add.w    #xoff,d0    ;center across
     move.w   down,d1
     add.w    #yoff,d1    ;center down
     ext.l    d0
     ext.l    d1
     gfxlib   writepixel
     endm

color macro
     move.l   rp,a1
     gfxlib   setapen
     endm

array macro             ;(address,BEQ=0)
  move.l  #size,d0
  move.l  #$10004,d1
  syslib  allocmem
  move.l  d0,\1
  beq     \2
  endm

evenpc macro
     ds.w     0
     endm

start:
  move.l  sp,stack
  movem.l a0/d0,-(sp)   ;save 1st parameter
address,length
open_libs:
  openlib intuition,intbase,done
  openlib graphics,gfxbase,close_int

set_up:
make_screen:
  openscreen myscreen,screen,close_libs
  openwindow mywindow,window,close_screen
   move.l  d0,a0
  movea.l ww.rport(a0),a1
   move.l  a1,rp
   movea.l window,a0
   intlib  viewportaddress
   move.l  d0,vp         ;viewport address
```

```
   movea.l  d0,a0
    lea     color_table,a1
    moveq    #16,d0          ;16 new colors
   gfxlib   loadrgb4

   movea.l  rp,a1
   move.l   #jam2,d0
   gfxlib   setdrmd
get_bit_planes:
   movea.l  rp,a1
   movea.l  4(a1),a1
    lea     bp1,a0
   move.l   8(a1),(a0)+    ;bitplane addresses
   move.l   12(a1),(a0)+
   move.l   16(a1),(a0)+
   move.l   20(a1),(a0)+
   move.l   24(a1),(a0)

memory:
   array   array1,close_window
   movea.l  d0,a4
   array   array2,close_out

random:
    nop
;   move.b   $bfe801,d3    ;CIA register
   movea.l  rp,a1
   movea.l  gfxbase,a6
   moveq    #0,down
r1 move.b   $bfe801,d4     ;CIA register
    nop
   moveq    #0,across
r2 move.b   $bfe801,d3
    nop
    mulu     d3,d4
    add.b    across,d4
    cmpi.b   #50,d4         ;maximum cell value
    bhi.s    r2
    move.b   d4,d0
    move.b   d4,sum
    cmpi.b   #0,d0          ;0 gets its own color
    beq.s    r2color
    asr.b    #2,d0          ;color/4
    addq.b   #1,d0
r2color
    color
    pset
   move.b   sum,(a4)+
    swap     d4
   addq.w   #1,across
   cmp.w    #len,across
    bne.s    r2
   addq.w   #1,down
   cmpi.w   #len,down
    bne.s    r1
   syslib   forbid
```

```
get_cli_input
   movem.l  (sp)+,a0/d0    ;parameter location
    movea.l  a0,a5
    move.l   d0,d7          ;# of characters
    subq     #1,d7
    beq.s    default        ;no parameters
    move.b   (a5)+,d0       ;get first value
    subi.b   #$30,d0        ; and normalize it
    lea      1(a5),a5       ;skip space or comma
    subq     #2,d7          ;2 less characters to read
    move.b   (a5)+,d1       ;get second value
    subi.b   #$30,d1        ; and normalize it
    lea      1(a5),a5       ;skip space or comma
    subq     #2,d7          ;2 less characters
    move.b   (a5)+,d2       ;get next value
    subi.b   #$30,d2        ; and normalize
    subq     #1,d7          ;last character?
    beq.s    clidone        ;branch if so
    move.w   #10,d3         ;that was 10's digit
    andi.w   #$0f,d2        ;clear rest of word
    mulu.w   d3,d2          ;times 10
    add.b    (a5),d2        ;add 1's digit
    subi.b   #$30,d2        ; and normalize
    bra.s    clidone
default:                    ;use default values
    move.b   #2,d0          ;K1
    move.b   #3,d1          ;K2
    move.b   #5,d2          ;GG
clidone:
    move.b   d0,k1
    move.b   d1,k2
    move.b   d2,gg
    moveq.b  #50,d0
    sub.b    gg,d0
    move.b   d0,diff        ;50-gg
    lea.l    bp1,a0

showit:
uleft                       ;upper-left,cell 0
   movea.l  array1,a4
   movea.l  array2,a5
    moveq    #0,d0
    move.b   (a4),d0        ;its value
   test    len*lenm1,lenm1,1,len

trow                        ;cells 1 - (length-2)
   movea.l  array1,a4
    lea      1(a4),a4       ;cell 1
   movea.l  array2,a5
    lea      1(a5),a5
    moveq    #0,across
   move.w   #lenm3,across  ;number of times
tr1
    moveq    #0,d0
   move.b   (a4),d0
   test    len*lenm1,-1,1,len
    lea      1(a4),a4
```

```
  dbf     across,tr1

uright                  ;upper-right,cell length-1
  movea.l array1,a4
  lea     lenm1(a4),a4
  movea.l array2,a5
  lea     lenm1(a5),a5
  moveq   #0,d0
  move.b  (a4),d0
  test    len*lenm1,-1,mlenm1,len

leftside
  movea.l array1,a4
  lea     len(a4),a4
  movea.l array2,a5
  lea     len(a5),a5
  moveq   #0,down
  move.w  #lenm3,down
ls1
  moveq   #0,d0
  move.b  (a4),d0
  test    mlen,lenm1,1,len
  lea     lenm1(a4),a4   ;move to
  lea     lenm2(a5),a5   ; rightside
  moveq   #0,d0
  move.b  (a4),d0
  test    mlen,-1,mlenm1,len
  lea     1(a4),a4
  dbf     down,ls1

lleft                   ;lower-left
  movea.l array1,a4
  lea     len*lenm1(a4),a4
  movea.l array2,a5
  lea     len*lenm1(a5),a5
  moveq   #0,d0
  move.b  (a4),d0
  test    mlen,lenm1,1,len*mlenm1

brow                    ;bottom row
  movea.l array1,a4
  lea     (len*lenm1+1)(a4),a4
  movea.l array2,a5
  lea     (len*lenm1+1)(a5),a5
  moveq   #0,across
  move.w  #lenm3,across
brow1
  moveq   #0,d0
  move.b  (a4),d0
  test    mlen,-1,1,len*mlenm1
  lea     1(a4),a4
  dbf     across,brow1

lright                  ;lower-right
  movea.l array1,a4
  lea     lenm1*lenp1(a4),a4
  movea.l array2,a5
  lea     lenm1*lenp1(a5),a5
  moveq   #0,d0
  move.b  (a4),d0
  test    mlen,-1,mlenm1,len*mlenm1

center                  ;center square
  movea.l array1,a4
  lea     lenp1(a4),a4
  movea.l array2,a5
  lea     lenp1(a5),a5
  moveq   #0,down
  moveq   #0,across
  move.w  #lenm3,down
12
  move.w  #lenm3,across
c1
  moveq   #0,d0
  move.b  (a4),d0
  test    mlen,-1,1,len
  lea     1(a4),a4
  dbf     across,c1
  lea     2(a4),a4
  lea     2(a5),a5
  dbf     down,12

switch                  ;for slower computers
  movea.l array1,a4
  movea.l array2,a5
  move.w  #lenm1,down
s1 move.w #lenm1,across
s2 move.b (a5)+,(a4)+
  dbf     across,s2
  dbf     down,s1

;  movea.l array1,a4
  movea.l array2,a5
  movea.l bp1,a1
  lea     byte(a1),a1
  move.l  #lenm1,down
qp5
  moveq   #wp1,across   ;length/32-1
qp4
  moveq   #$1f,d2       ;fill all 32 bits
qp3
  move.b  (a5)+,sum
;  move.b  sum,(a4)+
  cmpi.b  #0,sum
  beq.s   qp1
  asr.b   #2,sum
  addq.b  #1,sum
qp1
  asr.b   #1,sum        ;1st color bit to x
  roxl.l  #1,d3         ; and to d3
  asr.b   #1,sum        ;2d color bit to x
  roxl.l  #1,d4         ; and to d4
  asr.b   #1,sum        ;3d color bit to x
  roxl.l  #1,d0         ; and to d0
```

Circle 102 on Reader Service card.

Circle 101 on Reader Service card.

This Issue On Disk:

- **ARexx Disk Cataloger**
- **GetFile Shell for True BASIC**
- **Olé—An Arcade game Programmed in AMOS**
- **Programming the Amiga in Assembly Language Part VI**
- **Porting a B+Tree Library to the Amiga**
- **Computer Simulations in Assembly Language**
- **Wrapped Up in True BASIC**

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AC's TECH Disk
Volume 3, Number 2

A few notes before you dive into the disk!

- You need a working knowledge of the AmigaDOS CLI as most of the files on the AC's TECH disk are only accessible from the CLI.

- In order to fit as much information as possible on the AC's TECH Disk, we archived many of the files, using the freely redistributable archive utility 'lharc' (which is provided in the C: directory). lharc archive files have the filename extension .lzh.

  To unarchive a file *foo.lzh*, type *lharc x foo*
  For help with lharc, type *lharc ?*
  Also, files with 'lock' icons can be unarchived from the WorkBench by double-clicking the icon, and supplying a path.

Be Sure to Make a Backup!

CAUTION!

Due to the technical and experimental nature of some of the programs on the AC's TECH Disk, we advise the reader to use caution, especially when using experimental programs that initiate low-level disk access. The entire liability of the quality and performance of the software on the AC's TECH Disk is assumed by the purchaser. PiM Publications, Inc, their distributors, or their retailers, will not be liable for any direct, indirect, or consequential damages resulting from the use or misuse of the software on the AC's TECH Disk. (This agreement may not apply in all geographical areas)

Also, be extremely careful when working with hardware projects. Check your work, twice, to avoid any damage that can happen. Also, be aware that using these projects may void the warranties of your computer equipment. PiM Publications, or any of it's agents, is not responsible for any damages incurred while attempting this project.

```
   asr.b    #1,sum          ;4th color bit to x
   roxl.l   #1,d1           ; and to d1
   dbf      d2,qp3          ;do 32 times
   move.l   d1,$5dc0(a1)    ;all 4th color bits
   move.l   d0,$3e80(a1)    ;all 3d color bits
   move.l   d4,$1f40(a1)    ;all 2d color bits
   move.l   d3,(a1)+        ;all 1st color bits
   dbf      across,qp4
   lea      byteoff(a1),a1
   dbf      down,qp5
loop
   btst     #6,$bfe001      ;pressed LMB?
   bne      showit          ;branch if not

   syslib   permit
close_mem:
   movea.l  array2,a1
   move.l   #size,d0
   syslib   freemem
close_out:
   movea.l  array1,a1
   move.l   #size,d0
   syslib   freemem
close_window:
   movea.l  window,a0
   intlib   closewindow
close_screen:
   movea.l  screen,a0
   intlib   closescreen
close_libs:
   movea.l  gfxbase,a1
   syslib   closelibrary
close_int:
   movea.l  intbase,a1
   syslib   closelibrary
done:
   move.l   stack,sp
   rts

   evenpc

stack    dc.l  0
gfxbase  dc.l  0
intbase  dc.l  0
screen   dc.l  0
window   dc.l  0
rp       dc.l  0
vp       dc.l  0
array1   dc.l  0
array2   dc.l  0
bp1      dc.l  0
bp2      dc.l  0
bp3      dc.l  0
bp4      dc.l  0
bp5      dc.l  0
k1       dc.b  0
   evenpc
k2       dc.b  0
   evenpc
gg       dc.b  0
   evenpc
diff     dc.b  0
   evenpc

graphics dc.b 'graphics.library',0
   evenpc
intuition dc.b 'intuition.library',0
   evenpc

myscreen
   dc.w 0,0,320,200,depth
   dc.b  0,1
   dc.w  0
   dc.w customscreen
   dc.l  0,0,0,0
   evenpc
mywindow
   dc.w 0,0,320,200
   dc.b  0,1
   dc.l mousebuttons
   dc.l borderless!activate!rmb
   dc.l  0,0
   dc.l  0
   dc.l  0,0
   dc.w  0,0,0,0
   dc.w customscreen
   evenpc
color_table:
   dc.w $000,$12f,$24e,$36d
   dc.w $48c,$5ab,$6ca,$7e9
   dc.w $8e8,$9c7,$aa6,$be5
   dc.w $c64,$d43,$e22,$f01
   end
```

☑

Please Write to:
Bill Nee
c/o AC's TECH
P.O. Box 2140
Fall River, MA 02722-2140

Getfile
A Shell for True BASIC

by Will Steinsiek

One of the more powerful features found in True BASIC is its ability to redesign itself through the use of external Modules and Libraries. These are functions and subroutines which can either be preloaded and made part of the language itself or simply requested and called upon by any program that needs them. External Libraries, written in True BASIC, can be compiled or used as is. Compiled versions of routines written in other languages, such as C or Assembly, can also be set up for use. Once created, these subroutines can then be executed with a single line command.

True BASIC itself comes with many such Libraries. Information on how to make use of these Libraries within your own programs is found on the disk, either in a special file or in the form of comments attached to the code.

The AmigaLib is one such Library of routines. It is found in the TBLibrary folder and includes routines for speech, cycling colors on screen, and issuing commands through the CLI; and a routine for selecting a filename from a disk directory.

Unfortunately, this last routine has a problem that is referred to in the documentation. It will not work if you change screen modes with anything other than SET MODE "graphics". If, for instance, you reset the screen with SET MODE "LACEHIGH16", then calling on this routine will cause your system to crash. The problem can be resolved, however, by simply issuing the command SET MODE "graphics" before calling upon this routine to do its job.

There is an even better way, though. Instead of hoping that you remember to include the set mode command in your programming, you can write an External Library. External Libraries can, in fact, call other External Libraries in true structured programming fashion. The GetFileLib$ itself is actually a True Basic subroutine calling another machine language subroutine to do the job. Therefore we can easily design a routine that will take care of reseting the graphics mode for us before we access the filename function of the AmigaLib. While we are at it, we can also save our previous screen mode and screen, so that we can restore it as soon as we are finished.

The program GetFileLib does all that and spruces up the display a bit as well by providing some instructions for the user. It makes use of other routines found in a second Library included with True BASIC called IFF, which was designed to enable the user to display and use IFF graphic files such as those produced by *DeluxePaint*. As you will see, making use of this structured programming approach results in a much smaller program.

We will write GetFileLib as an External Library containing one subroutine, and sharing only one variable with the main program. All other variables within GetFileLib will remain isolated from the main program, so that any variable in our program sharing the same name used by the main program will not be accidently altered.

Creating an External Library is actually no different from the process of creating any other True BASIC program, except that it must begin with the word EXTERNAL on a line by itself at the top of the code. Convention also suggests the author include some comment lines at the beginning to identify the program, what it does, and how to use it from your main program. No other special effort is required here.

Type in Listing 1. You will note that it opens other libraries for its own use and calls routines from these in much the same way that our main program will call this routine.

When you are done, save this program as GetFileLib in the UsrLib drawer on your True BASIC program disk. Keeping your own Library routines in this particular drawer is suggested by the authors of True BASIC, but not actually required. Doing so right now, however, will make it easier for us to find it later.

The second listing will provide a test for our new External Library. It also illustrates how a very powerful program can be constructed with just a few lines using such Libraries. Save this program as IFFViewer.

Routines written in Assembly or C can also be used by True BASIC in much the same way. Once you have assembled and linked such a program, all that is missing is the proper file header, describing the program and specifying any parameters needed. A program called Finaltouch that comes with True BASIC is used to add this information to your program. It is located in the Assembly drawer on the True Basic disk.

There is more information on using your own Assembly routines within True BASIC in the Assembly.Doc file on disk 3 of your True BASIC disks, and in the Assembly drawer on the first disk there is also a sample program called MyOrd.asm. It illustrates how to tell your machine language routine where a particular string variable is located, and how to return a value to True BASIC.

Before calling such a subroutine True BASIC sets up a table in memory containing pointers for the arguments being passed to your subroutine. The start of this argument location table is found in A6, one of the address registers. Each pointer is four bytes long, and can be found by subtracting four from the value of A6. If the routine is a function, an additional pointer after all the others will point to the requested return variable.

As you can see, our main program serves as little more than a shell for calling the necessary external subroutines. The result is a very small, very capable little program.

When you are ready, run the program from within True BASIC. It will spend some time compiling itself and then present you with a scrolling list of files on the current disk. By clicking on the line labeled Path Name you can change disk drives, disks, etc. Insert a disk containing at least one graphic file. You can then scroll through the list of files and locate an IFF picture you wish to view. Double clicking on that file name will load and display the picture file. Pressing the mouse button again will return you to the file requester once more. From the file directory Select Cancel to return again to the BASIC editor.

As you can see, our main program serves as little more than a shell for calling the necessary external subroutines. The result is a very small, very capable little program.

Now that you've tried it out, feel free to modify either program. Maybe you would like to change the color scheme in the GetFileLib, or expand IFFViewer to include a slideshow option. Certainly you may want to compile the final programs. Once compiled they are essentially machine language routines with a header to tell True BASIC how to use them.

In the case of a string variable, this pointer tells the location of yet another pointer which points to the start of the string variable. In the case of a numeric variable or number, the pointer points to the location of the numeric value itself.

The following program in assembly code reads the value of a numeric variable passed to it by True BASIC and then returns that value to True BASIC. Although it does nothing very useful, it illustrates the proceedure and can form the basis for inserting your own routine.

Sample Assembly Language Routine

```
move.l   (a6),a1      ;pick up ptr to numeric
     move.l   -(a6),a2     ;and ptr to output arg
      moveq    #-1,d0       ;integer -1 value (with exp = -1)
      clr.w    d0           ;clear integer part
      move.l   (a1),d0      ;get numeric argument
        (Insert your own routine here - put result in d0)
done:
      move.l   d0,(a2)      ;save in output variable
```

```
    rts                 ;and done
end
```

Save this code as RETURN.ASM. Using the A68K assembler you would then assemble it as RETURN.O. Using BLINK RETURN.O will complete the assembly process.

Then load True BASIC and the program called Finaltouch found in the assembly drawer. To the first question reply, DEF RETURN(N). Then give the name of your assembled program, which should be RETURN. Finaltouch will do the rest. Make sure that the final program, RETURN, is placed in the USRLIB drawer on your True BASIC disk.

When it is ready, the following True Basic program wiill let you try it out.

```
Simple Test Program for
library "[usrlib]return"

declare def return
    let t = 5
let n = return(t)
print n
end
```

While not very useful, this routine and the one called MYORD.ASM found in the assembly drawer do illustrate procedures that can be used to combine True BASIC programs with machine language subroutines. Once you know how to do this, much more interesting things are possible.

Even though True BASIC on the Amiga has a lot of features to recommend it already, there are still many things missing that would make it a more suitable Amiga programing tool. Unlike AMOS, for instance, True Basic has no facility for handling sprites. The graphic capabilities of the latest Amiga computers are unknown to it, and a host of other sound and graphic capabilities inherent within the soul of the Amiga remain just out of reach within True Basic.

True BASIC is a language that is capable of changing, however, to meet the needs of its users. As more Amiga programmers provide new building blocks that can enable it to do new tasks or to accomplish even more with less work, True BASIC will grow more accustomed to its new home on the Amiga. Thanks to its modular design, it lies within our power to uniquely tailor this flexible language to fulfill the ongoing promise of the wonderful computer platform that is waiting at our fingertips.

Listing 1

```
= Shell for Getfile$ in AmigaLib
```

```
 PURPOSE: Corrects bug in Getfile$ function by
using a SET MODE "graphics" command before
calling Getfile$. Saves previous mode and screen
and restores them before returning. NOTE - Makes
special use of MODULE IFF_Library included with
True BASIC.
```

```
!
AUTHOR: Will Steinsiek - 12/28/92
```

```
!
 SUB GetFile (filename$)
    LIBRARY "{AmigaTools}IFF**"          ! Open
Required Libraries
    LIBRARY "{TBLibrary}AmigaLib**"
    DECLARE FUNCTION getfile$            ! Func-
tions used from Libraries
     DECLARE FUNCTION Ask_If_EHB$
     DECLARE FUNCTION Ask_If_HAM$
   ASK WINDOW lt,rt,lr,up                ! Save
Current Screen
    BOX KEEP lt,rt,lr,up in screen$
    ASK CURSOR row,col
    ASK MODE oldmode$
    LET EHB$ = Ask_If_EHB$
   LET HAM$ = Ask_If_HAM$
    CALL Save_SYS_colors                 ! Routine
found in IFF Library
    ! Reset screen mode to Workbench (uses
workbench colors)
    !       And create shell adding Instructions
for use
    SET MODE "graphics"
(    PLOT .05,0;.95,0;.95,.9;.05,.9;.05,0
    SET CURSOR 2,28
    PRINT "DIRECTORY OF FILE NAMES"
    SET CURSOR 4,17
    PRINT "To Change Disks Click on PATH NAME,
Delete Field"
    SET CURSOR 5,17
    PRINT "   And Enter Drive (DF0: DF1: RAM:
etc.)"
    SET CURSOR 6,17
    PRINT "To Select File Double Click on File
Name"
```

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```
    SET CURSOR 7,17
    PRINT "   Or Click Once and Select"
    SET CURSOR 11,8
    PRINT "PATH NAME:"
    SET CURSOR 14,8
    PRINT "FILE NAME:"
    LET filename$ = getfile$(150,70,t$,"SELECT")
    SET mode oldmode$                  ! Restore
previous screen
    IF EHB$ = "YES" then CALL EHB_ON   ! Routine
found in IFF Library
    IF HAM$ = "YES" then CALL HAM_ON   ! Routine
found in IFF Library
    CALL Restore_SYS_Colors            ! Routine
found in IFF Library
    SET window lt,rt,lr,up
    BOX SHOW screen$ at lt,lr
    SET CURSOR row,col
END SUB
```

Listing 2

```
   IFF Viewer Program using External Libraries to
select file for viewing and to display IFF Image
 Selecting Cancel or any non IFF file will return to
BASIC
! AUTHOR: Will Steinsiek  -  12/28/92
LIBRARY "{AmigaTools}IFF"          ! Libraries used,
including AmigaLib"
LIBRARY "{UsrLIB}GetFileLib"       !    called by
GetFileLib
  CALL GetFile(filename$)          ! Gets file name
into shared variable
  CALL MODE_Off
  CALL Read_IFF_Image(filename$,"IFF","IFF",0,1)
  DO until c = 0                   ! Wait for mouse
button to clear
    GET MOUSE a,b,c
  LOOP
  DO until c > 0                   ! Wait for mouse
button to be pressed
    GET MOUSE a,b,c
  LOOP
LOOP
END

GetFileShell For True BASIC
Will Steinsiek - 585 26 5018
212 Cardenas
Albuquerque, NM 87108
Phone: (505)  260 1837
```

☑

Please Write to:
Will Steinsiek
c/o AC's TECH
P.O. Box 2140
Fall River, MA 02722-2140

ARexx Disk Cataloger

ARexx is an interpreted interprocess communication (IPC) programming language. That's a mouthful. For novice Amiga users, IPC sounds difficult and probably not worth their time to learn and use. If I had said ARexx is an easy-to-learn programming language which can automate AmigaDOS chores accomplished on a regular basis, then ARexx might interest the novice programmer.

This article is about an ARexx disk Cataloger program that manipulates AmigaDOS to produce a text file containing information about the floppy disks (or hard drives) that you want cataloged. This program was designed for novice ARexx programmers and is limited to AmigaDOS commands. The best way to learn ARexx programming is to study program examples and use those examples to write your own ARexx programs.

The ARexx programming language, part of the Amiga Operating System (OS) 2.0 or purchased separately for OS V1.3, is for the masses. If you know anything about BASIC programming, then learning ARexx is reasonably easy. If you are new to any type of programming, you may need to purchase a book about ARexx programming. I highly recommend *Using ARexx on the Amiga* by Chris Zamara and Nick Sullivan (published by Abacus). This book is ideal for the novice and experienced ARexx user.

One day, I needed a listing of the contents of 11 disks. Since I misplaced the disk catalog program that I sometime used, I had to use the AmigaDOS command line interface (CLI) and my directory utility (SID) to catalog the disks. I was constantly using the keyboard, the arrow keys, and the mouse to execute the following CLI and SID commands;

- DIR > RAM:HoldIt df1: opt a <CR>, which redirects directory listing to the RAM file, 'HoldIt'
- AE <CR>, which loads my text editor
- Load 'RAM:HoldIt' text file into text editor and preform the following;
    a. insert blank lines at the top and bottom
    b. insert the disk volume name
    c. insert the remaining free disk space
- JOIN RAM:HoldIt and Catalog as Catalog.new (this makes a new file, 'Catalog.new' from the files 'RAM:HoldIt' and 'Catalog'. Catalog is the accumulation of the all the floppy disk that I want cataloged.)
- Use SID (a directory utility) to;
    — DELETE RAM:HoldIt and RAM:Catalog
    — RENAME RAM:Catalog.new to RAM:Catalog

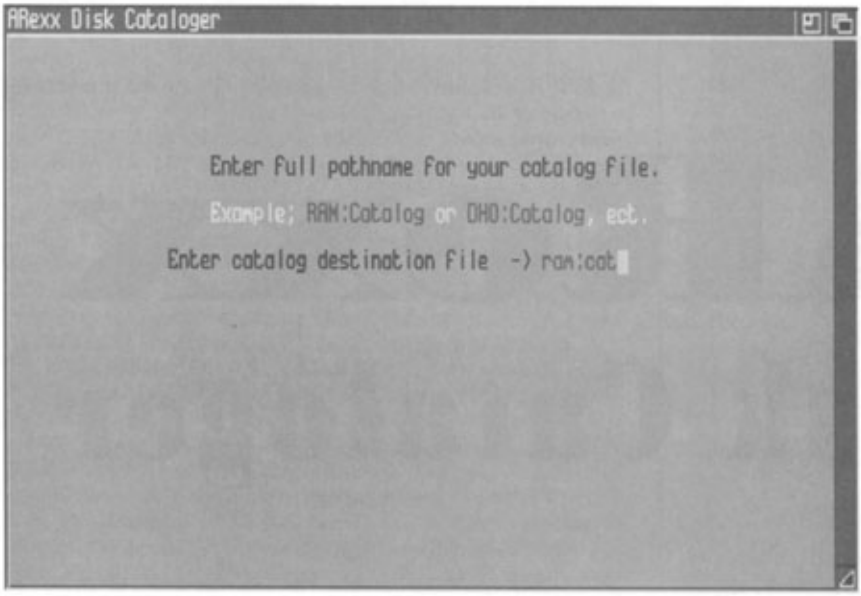
Then I would start the process over for another disk. While I was creating my catalog file, I thought that a small ARexx program could accomplish this process. At the time, I knew very little about the ARexx language, but its commands appeare? uncomplicated. Now to discuss various ARexx programming techniques I discovered while writing the ARexx Cataloger program.

An AmigaDOS script could do what the ARexx Cataloger does, but it would be much more difficult for an AmigaDOS script to handle the Cataloger's flexible response to user input and its ability to determine the peripheral resources available on a given Amiga computer system.

Listing 1 is the Cataloger program. The line numbers in the program are for reference purposes only and are not part of the ARexx Cataloger program. When you type in the program, omit the line numbers. The code is documented to explain program flow and ARexx commands.

The ARexx Cataloger evolved as I learned about ARexx. The final program has nine sections. The sections are;

1. Mandatory comment statement at the beginning of the file. It is unnumbered.
2. Create a customized input/output window for the program, lines 1 to 13.
3. Setup, which has three parts;
    a. Initialize constants, lines 14 to 25,
    b. Check system for resources and DOS commands, lines 26 to 100, and
    c. Load the system disk devices, lines 102 to 119.
4. Get the source disk drive, lines 120 to 147.
5. Get the destination device and filename, lines 148 to 235.



6. Read the disk in the source drive and build the Catalog, lines 236 to 327.
7. Print the results, lines 3286 to 380.
8. Clean up and close out, lines 381 to 386.
9. Program procedures, 387 to 449.

As you study the sections, you will notice all the sections support section six, which is the code that creates the catalog file. In order for section six to produce a catalog file, the preceding sections must initialize variables and accept keyboard inputs, so it can adapt to any Amiga computer system setup.

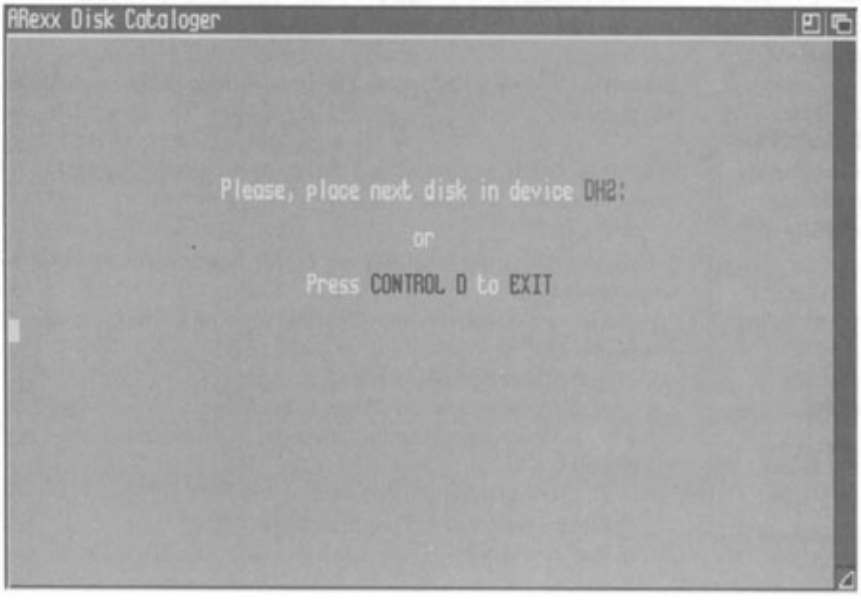
The first section of the program is the required ARexx program comment line (denoted by the start comment symbol /* and the end comment symbol */). Lines 4, 6, and 74 are examples of comment usage within a program. The only required comment is the very first line of an ARexx program. When ARexx encounters the /* symbol it ignores everything until it encounters the */ symbol. Other comments throughout the program are to document program flow. I recommend liberal use of comments to document program flow, even if you create ARexx programs for your use only. Following the comment is section two of the Cataloger program, the customized input/output window.

The customized window allows you to create a window sized to your ARexx program requirements. STDIN and STDOUT are filenames assigned by ARexx to the CLI window it opens when you pass a program to ARexx. All interactive input/output (I/O) is handled by the STDIN and STDOUT files. Since the ARexx Cataloger requires constant user interaction, its customized window is the same size and attributes of the normal 640 x 200 hi-res Workbench screen (reference line 3). ARexx treats this customized window as a file and redirects the input and output to the window. A modification of the customized window code can result in two different windows with STDOUT assigned to one window and STDIN assigned to the other window. Listing 2 is an example of this type of modification.

Section three of the Cataloger program initializes the variables used in the program and determines the peripheral resources (disk drive devices).

A one dimensional array _cmdr and three escape sequence variables are initialized at the beginning. The _cmdr array is a list of AmigaDOS command names. The program uses the PATH, INFO, DELETE, JOIN, and ECHO AmigaDOS commands. The Cataloger is flexible in that it searches all the system loaded paths for the commands. It does this by loading a text file in RAM (line 40) and then uses the information in the file to create a second one dimensional array called path. Listing 3 is an example of the text file created by Cataloger from which it determines the search path for the AmigaDOS commands. Following the _cmdr array are the escape sequence variables color_1 through color_3.

Cataloger uses escape sequences (see page 7-45 of the Amiga OS 2.04 manual for a listing of Standard Escape Sequences for Console Window) to change the ARexx window pen color in the middle of a string. This was necessary when a string contained two or more different colors. The 1bx part of the escape sequence (line 23 to 25) is the hexadecimal representative of the escape key, which is where the term escape sequences originates. An interesting problem surfaced when I used the color_1 through color_3 variables with the center and say functions.



Clockwise from the top: 1. Catalog destination requestor. 2. Read-disk information screen. 3. Catalog source requestor. 4. Next disk requestor.

The center function, as used in the Cataloger, centers a string based on the width you pass to the function. For example;

var = center("Center this string",80)

will return a string to var with 31 leading spaces, followed by "Center this string", and then 31 more spaces. If the 80, which is the width, is changed to 60, then "Center this string" would have 21 leading and trailing spaces. When center is combined with the say statement, the string is centered and printed on the STDOUT (assuming you used the appropriate width for the STDOUT window). Due to the window borders, center functions in the ARexx Cataloger are based on 77 characters width.

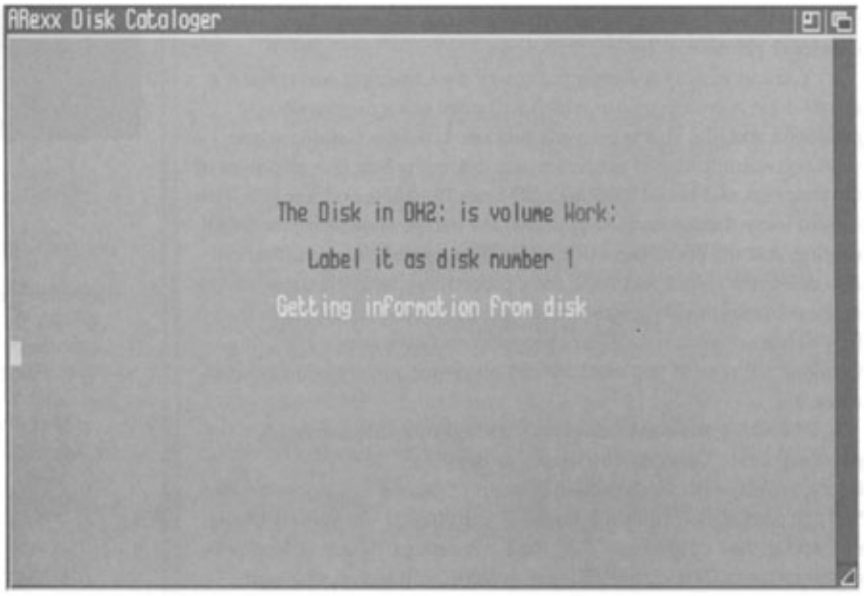
When escape sequences are imbedded in a string their length must be included in the width or the string will not be centered on the screen. Reference line 17 of Listing 1. The escape sequence 1bx[32m is five non-printable characters in length. The 1bx counts as one character. To ensure the text string in line 17 centers on the STDOUT, then the five characters must be added to the required 77. This is why 82 was used in the center function of line 17. For every escape sequence, add five to the 77 width and the strings will remained centered in the STDOUT window. If I used 83 for the width in this example (one more than what I can get on the screen), then ARexx would follow the text string with a blank line. This is an simple method to get a line of text on the screen followed by a blank line with one ARexx statement.

The || symbols are used throughout the program to put together (concatenate) text strings and escape sequences. Reference line 126 for an extreme example of || symbol usage.

Pen color procedures are at the end of the Cataloger program (lines 405 to 415; named color1, color2, and color3). The color procedures use escape sequences with the AmigaDOS ECHO command to change the pen color which uses the *E symbol (rather than the 1bx used by ARexx) to represent the escape key. They are used to change the pen color for a whole line of text.

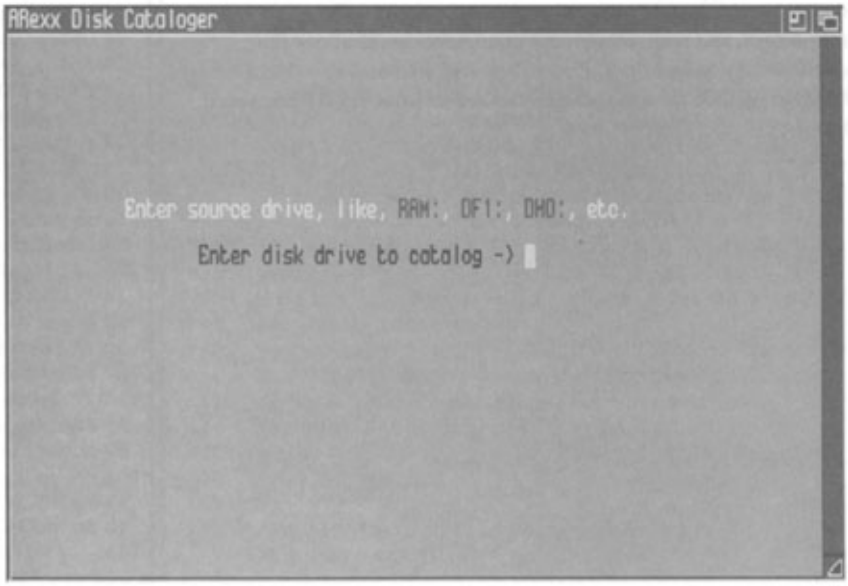
The program generates another one-dimensional array during the initialization process called drive in section three. It uses the AmigaDOS INFO command (line 103) to create a text file in RAM. Listing 4 is a sample of the INFO command generated text file. The program searches through the file one line at a time until it locates the line that has 'Unit' as the first word (line 109). This line is discarded, then it loads the drive array with the system drive unit(s) (line 115). The program exits the load drive loop when it locates the blank line before 'Volumes available:' (line 112). Cataloger uses the drive array to determine if the source drive and destination filename are valid devices and filename for your system.

If you use a system utility, which allows the computer system to read both Amiga and MS-DOS disks on the same drive, the Cataloger program will read and catalog both types of disks. There is a problem associated with this dual drive identity that is



error trapped (line 207 to 230) and will cause the Cataloger to display a rather lengthy discussion of the problem. For example, if the Amiga DF1: disk drive is also known to the computer system as MS-DOS MD1: disk drive (i.e., two logical devices sharing the same physical drive), and DF1: is entered as the source drive and MD1:Catalog is entered as the destination; then the program will error trap the problem and explain it on the screen. If you avoid this dual drive conflict, the ARexx Cataloger will even catalog your MS-DOS disks without incident, if you have a MS-DOS utility installed.

The Cataloger will catalog as many disks as your storage space will allow. Press CONTROL D to exit the read disk routine. It could take up to 2.5 seconds to exit after depressing CONTROL D, so be patient. When you exit the read disk routine, you are asked if you want to print the cataloged file. If you answered yes (i.e., upper or lower case 'Y'), set your printer and press the return key to start the printing. The program creates a header for the catalog file which is a summation



of the disk read by the program. Listing 5 is an example of the Cataloger printout.

You can modify the print portion of the Cataloger and make it a stand-alone ARexx program which will print out a previously cataloged text file. This is a simple process. Load the Cataloger into your text editor or word processor and delete the first line comment of the program and lines 15 through 21? lines 26 to 350, and line 379. This should leave the customized window, the escape sequences, the print routine, and the procedures portion of the original program. You can also delete the color1 and fatal_error procedures, since they are not use in the print routine. When this is complete, add the following to the first 13 lines of your new ARexx program and save it as CatalogPrint.rexx. If you used a word processor, ensure you save it as a text file.

```
/* Catalog printout : usage; rx CatalogPrint <filename> */
parse arg dest /* assigns <filename> to dest */
if length(dest) = 0 | ~exists(dest) then do /* <filename> doesn't exist
*/? call screen_cls? call skip_lines(6)? call color3? say center('Usage;
rx CatalogPrint <filename>',77)? say? say center('Where <filename>
is pathname to Catalog file',77)? delay(200)? call screen_cls? exit
end
```

The finale to the Cataloger project is to make the program selectable from the Workbench environment. This is easy to do, if you have a directory utility like the shareware SID program. Workbench can also duplicate the icon by selecting Icon Copy from the Workbench menu. Once the Shell icon is duplicated, rename it Cataloger. Then highlight the icon by clicking on it once and then simultaneously press the right Amiga key and the I key (upper or lower case) for Icon Information. This brings up the Information Requester. Erase any information in the Default Tool window and enter rx as the default tool. Select and delete any information in the tool types window. Save the this information and relocate the icon to any directory in your system. When you double click the Cataloger icon, ARexx will look in the Rexx directory for the program and execute it.

ARexx is a programming language for the masses. Even a novice ARexx programmer can write impressive programs. The exciting aspect of ARexx is its flexibility. Individual creative ideas are the only limit for what ARexx can do for you. Your creative ideas and viewpoint could modify the ARexx Cataloger program and make it better than it is or you could write other cosmic programs. Once you jump into ARexx, and realize that it can manipulate applications (like *excellence!*, *SuperBase Pro 4*, *Proper Grammar*, etc.) as easy as it manipulates AmigaDOS then the possibilities are endless. Try ARexx, you'll like it.

Listing 1

```
/* Catalog.rexx script : usage : rx Catalog.

  Required material, programs and functions;
   AREXX programming language
   rexxsupport.library
   AmigaDOS commands
      info
      delete
      join
      dir
      echo
*/
1 close('STDIN') /* close current standard input */
2 close('STDOUT') /* close current standard output */
3 if open("STDOUT","con:0/0/640/200/ARexx Disk
Cataloger","W") then do /* open a new window */
4   PRAGMA("*","STDOUT") /* redirect to new window */
5  if ~open("STDIN","*","R") then do
6     /* if open & reassign not successful, reopen old
STDIN & STDOUT */
7      close("STDOUT")
8      PRAGMA("*") /* open '*', console handler */
9     open("STDOUT","*","W")
10    open("STDIN","*","R")
11     exit  /* exit out of the script */
12     end
13 end  /* of 'if open("STDOUT", .... */
14 /* initialize */
15 call screen_cls
16 call skip_lines(8)
17 say center('1b'x'[32m' || 'Initializing Program',82)
18 _cmdr.1 = 'INFO'
19 _cmdr.2 = 'DELETE'
20 _cmdr.3 = 'JOIN'
21 _cmdr.4 = 'DIR'
22 /* escape sequences */
23 color_1 = '1b'x'[31m'
24 color_2 = '1b'x'[32m'
25 color_3 = '1b'x'[33m'
26 /* is AREXX support library available and loaded? */
27 if ~exists('libs:rexxsupport.library') then do
28   call screen_cls
29   do t=1 to 8   /* skip eight lines */
30     say ' '
31   end
32  errtext = 'Cannot find libs:rexxsupport.library!'
33   call fatal_error
34   exit     /* exit from script */
35 end
36 /* load support library */
37 address command 'rxlib rexxsupport.library 0 -30 0'
38 /* load search path into RAM: file */
39 address command 'path > ram:holdit'
40 open('file','RAM:holdit',R) /* open file for reading
*/
41 count = 0  /* determines number of paths to search */
42 do while ~EOF('file') /* while path data available */
43   /* load path into path array element */
```

```
44  path.count = strip(ReadLn('file'))
45   if right(path.count,1) ~= ":" then do
46     path.count=path.count'/'
47    end
48   count = count+1 /* increment path element counter
*/
49 end
50 close('file') /* close the temporary file in RAM: */
51 success = 0    /* initialize flag */
52 do n=1 to 4 /* search for JOIN, INFO, DELETE, and DIR
*/
53    flag = -1   /* set flag */
54    do j=1 to count
55      /* if _cmdr.n exists, reset flag */
56      if exists(path.j || _cmdr.n) then flag = 1
57    end
58    if flag = -1 then do
59      /* if flag not reset, then command not present
*/
60       success = -1   /* command not found flag set */
61       call screen_cls
62       call skip_lines(8)
63      say center('1b'x'[31m' 'You are missing the
command' '1b'x'[33m'_cmdr.n || '1b'x'[31m!',92)
64      delay(200) /* wait four seconds, then continue
*/
65       call screen_cls
66    end
67 end
68 if success = -1 then do
69    /* one of the commands was not found */
70    errtext = "One or more command programs missing
from current search path(s)."
71    call fatal_error
72    exit  /* exit script */
73 end
74 /* If OS 2.0 is used, then ECHO and PATH are resident
to the system.  Otherwise, check the paths for echo and
assume that the command PATH is available from the
system.
75    Determine if OS 2.0 is being used
76 */
77 a =showlist('L','exec.library',,'a') /* lib address */
78 b =offset(a,20)  /* add 20 to address */
79 c =import(b,2)   /* get two characters from address */
80 d =C2D(c)        /* convert to decimal numbers */
81 if d < 37 then do /* version 1.3 and below < 37 */
82    count1 = 1     /* check for ECHO in version 1.3 */
83    do forever
84      if exists(path.count1 || 'ECHO') then do
85         leave     /* exit for loop */
86       end
87       if count1 = count then do
88         /* ECHO not found in any system search paths
*/
89          call screen_cls
90          call skip_lines(6)
91          say center(color_2 || 'F A T A L   E R R O
R',83)
92          say center(color_1 || 'I can not find the' ||
'1b'x'[33m ECHO' || '1b'x'[31m command!',93)
93          say center(color_2 || 'Press <RETURN> key  to
exit',83)
94          parse pull dummy  /* wait for RETURN key */
95          call screen_cls
96          exit  /* exit script */
97       end
98       count1 = count1 + 1  /* inc element counter */
99    end
100 end
101
102 /* Determine drive devices on the host system.
Redirect INFO data to ram:.  Then open as read only, file
pointer at the top of file */
103 address command 'Info > RAM:Holdit'
104 open('file','RAM:Holdit',R)
105 flag = 0 /* initialize program flow flag */
106 max_element = -1  /* initialize device. counter */
107 do while ~EOF('file')
108   line = strip(upper(ReadLn('file')))
109    if left(line,4) = "UNIT" then flag = 1 /* change
program flow within the loop */
110    if flag = 1 then do
111      /* look for blank line in the file just prior
to mounted devices listing */
112       if length(line) = 0 then leave   /* when blank
line located */
113       max_element = max_element + 1    /* increment
element counter */
114       /* load drive designator */
115     drive.max_element = strip(upper(word(line,1)))
116    end
117 end
118 close('file')
119 address command 'delete > NIL: RAM:Holdit'  /* delete
file RAM:Holdit */
120 /* Get the source drive */
121 call screen_cls
122 do forever   /* get source disk drive */
123    flag = 0   /* initialize exit flag */
124    call screen_cls
125    call skip_lines(6)
126    say center(color_1 || 'Enter source drive, like, '
|| color_3 || 'RAM:' || color_1 || ', ' || color_3 ||
'DF1:' || color_1 || ', ' || color_3 || 'DH0:' || color_1
|| ', etc.',113)
127    Options Prompt '' || color_2 || left(' ',18) ||
'Enter disk drive to catalog -> ' || color_3
128    parse pull CatDrive  /* get user input for source
drive */
129    call screen_cls
130   CatDrive=strip(UPPER(CatDrive)) /* upper case */
131    /* see if user put ':' on the end of device name
*/
132   n=pos(":",CatDrive,1)
133    if n=0 then CatDrive = CatDrive':'  /* put the ':'
on the selection, if user doesn't */
134    do n=1 to max_element
135       if drive.n = CatDrive then do
136          flag = 1 /* match found, valid device */
137          leave    /* exit loop */
138       end
139    end
140    if flag = 1 then leave /* the forever do loop */
141    call skip_lines(6)
142    say center(color_3 || CatDrive || color_2 || ' is
not a drive currently loaded on your system.',88)
143    delay(150)  /* wait three seconds */
144    say center(color_1 || ' Try again!',83)
145    delay(75)
146    call screen_cls
147 end
148 /* Get destination file for the catalog */
149 call screen_cls
```

```
call skip_lines(4)
say center(color_2 || 'It is best to locate your
catalog file in ' || color_3 || 'RAM' || color_2 ||
',',93)
say center('especially if you have only one disk
drive.',78)
delay(150)
call screen_cls
do forever  /* get a valid destination file */
  call skip_lines(4)i
  say center(color_2 || 'Enter full pathname for your
catalog file.',83)
  say center(color_1 || 'Example; ' || color_3 ||
'RAM:Catalog ' || color_1 || 'or ' || color_3 ||
'DH0:Catalog' || color_1 || ', ect.',103)
  options prompt color_2 || left(' ',15) || 'Enter
catalog destination file -> ' || color_3
  parse pull dest  /* get destination from STDIN */
  call screen_cls
  dest = strip(upper(dest))
  j = pos(':',dest,1)  /* find position of colon */
  select
    when length(dest) = j then do /* colon is last
*/
      /* indicates only a device was entered */
      call skip_lines(6)
      say center('You must select a file in the
destination pathname!',77)
      say center(color_1 || 'Try again!!',83)
       delay(200)
       call screen_cls
      end  /* 'when length(dest)' selection */
    when j = 0 then do /* colon not present, error
*/
      /* indicates no device was entered */
      call skip_lines(6)
      say center(color_3 || dest || color_2 || '
is an,',88)
      say center(color_2 || 'Incorrect drive/file
selection!',83)
      say center(color_1 || 'Try again!!',82)
       delay(200)
       call screen_cls
      end  /* of 'when j = 0' selection */
    when j > 1 then do /* format correct, see if a
valid filename was used */
      /* assumes a device & file were entered */
      flag = -1  /* initialize flag */
      do n=1 to max_element  /* check device name
*/
        if drive.n = left(dest,j) then flag = 1 /
* device is on system */
       end
       if flag = -1 then do
         /* pathname device, not part of system */
         call skip_lines(6)
         say center(color_3 || left(dest,j) ||
color_2 || ' is an',88)
         say center(color_2 || 'Invalid drive
selection!',83)
         say center(color_1 || 'Try again!!',82)
          delay(200)
          call screen_cls
         end
      else if abbrev(dest,CatDrive) then do
         /* CatDrive string is in dest string */
         call skip_lines(8)
         say center(color_2 || 'Sorry, but you can
not use your ' || color_3 || 'catalog drive ' || color_2
|| 'as your ' || color_3 || 'destination',97)
          delay(200)
          call screen_cls
         end
      else if ~abbrev(dest,CatDrive) then
        /* valid system destination selected,
check for logical and physical disk drive conflict */
        PRAGMA('W','N')  /* turn off disk re-
questors */
        if ~open('Cat',dest,'W')then do /* open
filenamed 'dest' */
          call screen_cls
          call skip_lines(2)
          call color2
          say left(' ',15) || 'Source Drive' ||
left(' ',15) || 'Destination Drive'
          call color1
          say left(' ',15) || CatDrive || left('
',27-length(CatDrive)) || dest
          call color3
          say center('Invalid device used, most
likely due to logical device',77)
          say center('and physical device
conflict. This could occur when using a',77)
          say center('MultiDOS type utility
programs. These allow you to read both',77)
          say center('AmigaDOS and MS-DOS disks
in the same physical Amiga drive.',77)
          call color2
          say center('Ensure you are not using a
MS-DOS logical device',77)
          say center('as part of your destina-
tion filename.',77)
          call color1
          Options Prompt center('Press RETURN
key to continue',77)
          parse pull dummy
          call screen_cls
          end
        else do
          close('Cat')
          leave /* exit forever loop */
        end  /* of 'if ~open('Cat',dest .... */
    end  /* of 'when j > 1' & 'if' statements */
    otherwise
      /* NoOp, don't exit */
  end /* end of select */
end  /* of forever loop */
/* Create the Catalog file */
PRAGMA('W','N')  /* turn off disk requestors */
open('Cat',dest,'W') /* open filenamed 'dest' */
WriteLn('Cat',' ')  /* blank line separator */
close('Cat')
open('test','RAM:Lines','W')
/* make a file with three blank lines */
WriteLn('test',' ')
WriteLn('test',' ')
WriteLn('test',' ')
close('test')
open('head','RAM:DiskHeader','W')
/* Create header file */
WriteLn('head',' ')
WriteLn('head',left(' ',6) || 'Catalog File prepared
on 'date()'.')
WriteLn('head',' ')
```

```
252 WriteLn('head',left(' ',6) || 'DISK #  Volume Name')
253 WriteLn('head',left(' ',6) || left('-',6,'-') ||
left('-',27,'-'))
254 WriteLn('head',' ')
255 close('head')
256 /* log disk until CONTROL D is pressed */
257 DISK = 0  /* initialize disk counter */
258 call screen_cls
259 signal on BREAK_D /* CONTROL D interupt on */
260 old_dir = "SYS:"  /* initialize to SYS: device */
261 vol_name = "SYS:"
262 do forever  /* until CONTROL D is selected */
263   if exists(CatDrive) then do /* is disk in drive */
264     call screen_cls
265     call skip_lines(6)
266    address command 'info > RAM:info_hold' CatDrive
267    open('file','RAM:info_hold','R')
268     do k=1 to 4   /* 4th line contains 'CatDrive'
volume information */
269       data = ReadLn('file')
270      end
271     close('file')
272     n = words(data)   /* how many words in 'data'?
*/
273     vol_name = strip(word(data,n)) || ':'   /*
last word in string is volume name */
274    if vol_name = 'present:' then do /* occurs when
disk is not present in CatDrive */
275       vol_name = old_dir   /* traps for no disk in
'dest' */
276      end
277     if vol_name ~= old_dir then do    /* wait for
the old disk to be removed */
278       diskBL_used = value(word(data,3)) /* blocks
*/
279       diskBL_free = value(word(data,4)) /* blocks
*/
280       disk_size = strip(word(data,2))   /* K or M
*/
281       sz = right(disk_size,1) /* get 'K' or 'M' */
282      size = substr(disk_size,1,length(disk_size)-
1) /* numeric size of disk */
283        if sz = "M" then do
284          size = size * 1000 /* MegaByte size disk
*/
285         end
286       disk_free  = strip(value(size *
(diskBL_free/(diskBL_used + diskBL_free))))  /* convert
to string */
287       n = pos('.',disk_free) /* decimal point */
288        if n ~= 0 then do
289         disk_free = substr(disk_free,1,n-1) ||
'K'  /* get only KiloBytes */
290        end   /* end of 'if n ~= 0 .... */
291        old_dir = vol_name   /* to ensure it will
not take back to back disk of the same name */
292        DISK = DISK + 1     /* inc disk counter */
293      open('head','RAM:DiskHeader','A') /* append
info to header file */
294        a = center('    ' || DISK || '    ',8) /*
take the center eight characters */
295        a = '    ' || a || '    ' || vol_name
296       WriteLn('head',a)
297       close('head')  /* close header file */
298       say center(color_2 || 'The Disk in' CatDrive
'is volume ' || color_3 || vol_name,88)
299       say center(color_2 || ' Label it as disk
number ' || color_3 || DISK,88)
300       say center(color_1 || 'Getting information
from disk',83)
301       open('Cat',dest,'A') /* open, append header
*/
302       WriteLn('Cat','DISK Number' DISK || ',
Volume Name ->' vol_name)
303       WriteLn('Cat','Free disk space' disk_free
'Kb')
304        WriteLn('Cat','')
305        close('Cat')
306 /*
307   using AmigaDOS, create a file in RAM: called
'_dir_file', then join the three files in RAM: (the
catalog file, _dir_file, and Lines as the file RexxCat,
which is the complete catalog file to date.  Then delete
the old catalog file 'dest'.  Once completed, copy
RAM:RexxCat to 'dest' as the new, up to date, catalog
file.  Clean up by deleting RAM:RexxCat and
RAM:_dir_file. Leave 'RAM:Lines' alone.
308 */
309       address command 'dir > RAM:_dir_file'
CatDrive 'opt a'
310       address command "join > NIL: " dest
"RAM:_dir_file RAM:Lines as RAM:RexxCat"
311       address command "join > NIL: " dest
"RAM:_dir_file RAM:Lines as RAM:RexxCat"
312       address command 'copy > NIL: RAM:RexxCat To'
dest ' quiet'
313        call screen_cls
314      end   /* end of 'if vol_name ~= .... */
315   end   /* end of 'if exists(CatDrive) .... */
316   call screen_cls
317   call skip_lines(4)
318   call color1
319   /* second method to center up text on STDOUT */
320   say left(' ',20) || 'Please, place next disk in
device ' || color_3 || CatDrive
321   call color1
322   say left(' ',37) || 'or'
323   say ''
324   say center('Press ' || color_2 || 'CONTROL D ' ||
color_1 || 'to ' || color_2 || 'EXIT',92)
325   delay(100)   /* wait 2 seconds for multitasking
*/
326   call screen_cls
327 end   /* end of forever loop */
328 BREAK_D:  /* forever loop exit point */
329 signal off BREAK_D  /* turn off error trapping */
330 address command 'join > NIL: RAM:DiskHeader ' dest
'as RAM:RexxCat'
331 address command 'copy > NIL: RAM:RexxCat To' dest '
quiet'
332 address command 'delete > NIL: RAM:DiskHeader'
333 address command 'delete > NIL: RAM:Lines RAM:RexxCat'
334 address command 'delete > NIL: RAM:info_hold
RAM:_dir_file'
335 if DISK == 0 then do /* ensures no exit without
reading at least one disk */
336   address command 'delete > NIL:' dest   /* erase
empty file that was created, but nothing was put in it */
337   call Control_Exit
338   exit  /* allow no printing */
339 end
340 do forever  /* until the Y, y, N, or n selected */
341   call screen_cls
342   call skip_lines(8)
```

```
343   Options Prompt color_2 || left(' ',7) || 'Do you
want to print catalog file just created (Y/N)? '||
color_3
344    parse pull decision
345    call screen_cls
346   decision = strip(upper(decision))
347    if decision = "Y" | decision = "N" then leave
348 end  /* end of do forever */
349 call screen_cls
350 if decision = "Y" then do
351    do forever  /* ensure printer online */
352      A = open('printer','PRT:','W')
353       /* open printer just like any other device */
354       select
355         when A == 0 then do  /* PRT: not ready */
356            call screen_cls
357            call skip_lines(6)
358           say center(color_3 || 'Please place the
printer on line so I can print the file.',83)
359           say center(color_2 || "I'll try again in
five seconds!",77)
360            delay(250)     /* multitask wait for 5
seconds */
361          end
362         otherwise
363           leave     /* printer is ONLINE */
364       end   /* of 'select' */
365    end  /* end of do forever */
366    linecount = 0  /* initialize PRT: line counter */
367    page = 0       /* initialize PRT: page counter */
368   open('Cat',dest,'R') /* open catalog file */
369    call prt_header
370    do while ~EOF('Cat') /* keep going until EOF */
371       line = ReadLn('Cat')
372       linecount = linecount + 1  /* inc line counter
*/
373       if linecount >= 60 then do /* allow 1" margins
*/
374         WriteLn('printer','0C'x) /* send formfeed */
375          call prt_header
376          end
377       else  /* print line with six leading spaces */
378         WriteLn('printer',left(' ',6) || line)
379    end   /* end of 'if' and 'do while' statements */
380 end  /* while ~EOF() */
381 /* cleaning up all items */
382 if exists('printer') then do
383    close('Cat')   /* if not closed, close now */
384   WriteLn('printer','0C'x) /* send formfeed */
385    close('printer')  /* close printer */
386 end
387 call Control_Exit
388 close('STDIN') /* close custom input window */
389 close('STDOUT')  /* close custom output window */
390 PRAGMA("**")  /* open '*', console handler */
391 open("STDOUT","**","W") /* Redirect output to ARexx
*/
392 open("STDIN","**","R")  /* Redirect input to ARexx */
393 exit  /* end of program */
394 /* procedures */
395 prt_header: procedure expose linecount page
396    page = page + 1     /* inc page counter */
397   WriteLn('printer',' ')
398   WriteLn('printer',' ')
399   WriteLn('printer',left(' ',8) || 'Catalog File,
page ->' page)
400   WriteLn('printer',' ')
401   WriteLn('printer',' ')
402    linecount = 5
403 return
404 /* following procedures use escape sequences to
change the pen color */
405 color1: procedure  /* default text color 1 */
406   address command 'echo "*E[31m"'
407 return
408
409 color2: procedure  /* default text color 2 */
410   address command 'echo "*E[32m"'
411 return
412
413 color3: procedure  /* default text color 3 */
414   address command 'echo "*E[33m"'
415 return
416
417 /* escape sequence to clear screen */
418 screen_cls: procedure
419   address command 'echo "*E[0;0H*E[J"'
420 return
421 /* jump down "lines" on the screen */
422 skip_lines: procedure
423    parse arg lines  /* lines passed as an argment */
424    do n=1 to lines
425       say   /* blank line */
426    end
427 return
428 /* error message for script termination  */
429 fatal_error: procedure expose errtext
430    call screen_cls
431    call skip_lines(6)
432    call color2
433    say center('F A T A L   E R R O R',77)
434    call color3
435   say center(errtext,77)
436    call color1
437   say center('Press RETURN key to exit',77)
438    parse pull dummy
439    call screen_cls
440  return
441 Control_Exit: procedure
442    call screen_cls
443    call skip_lines(6)
444    call color3
445    say left(' ',25) || 'Exiting ARexx Catalog Script'
446    delay(100)  /* two seconds then exit */
447    call screen_cls
448 return
449 /* end of Cataloger.rexx script */
```

Listing 2

```
/* 2WindowDemo.rexx, a 2 customized window demo */
close('STDIN')
close('STDOUT')

if open("STDOUT","con:0/0/640/99/Window 1","W") then do
  PRAGMA("**","STDOUT")
  if ~open("STDIN","con:0/99/640/100/Window 2","R") then
do
```

```
    close("STDOUT")
     PRAGMA("***")
    open("STDOUT","**","W")
   open("STDIN","**","R")
     exit
     end
end
say center('Testing STDOUT Window #1',77)
say center("Enter 'Testing' in Window 2 to exit",77)
options prompt '                              '
parse pull variable  /* get input from STDIN */
say
say center(variable,77)
close('STDIN')
close('STDOUT')
PRAGMA("***")  /* open '*', the console handler */
open("STDOUT","**","W") /* reopen the ARexx window */
open("STDIN","**","R")
```

Listing 3

```
Current_directory /* first line of PATH output */
RamDisk:
BootDrive:c
BootDrive:c/c_add
BootDrive:Utilities
BootDrive:Rexxc
BootDrive:System
BootDrive:s
BootDrive:Prefs
BootDrive:WBStartup
BootDrive:PC
BootDrive:Tools
BootDrive:Tools/Commodities
BootDrive:
C:          /* last line */
```

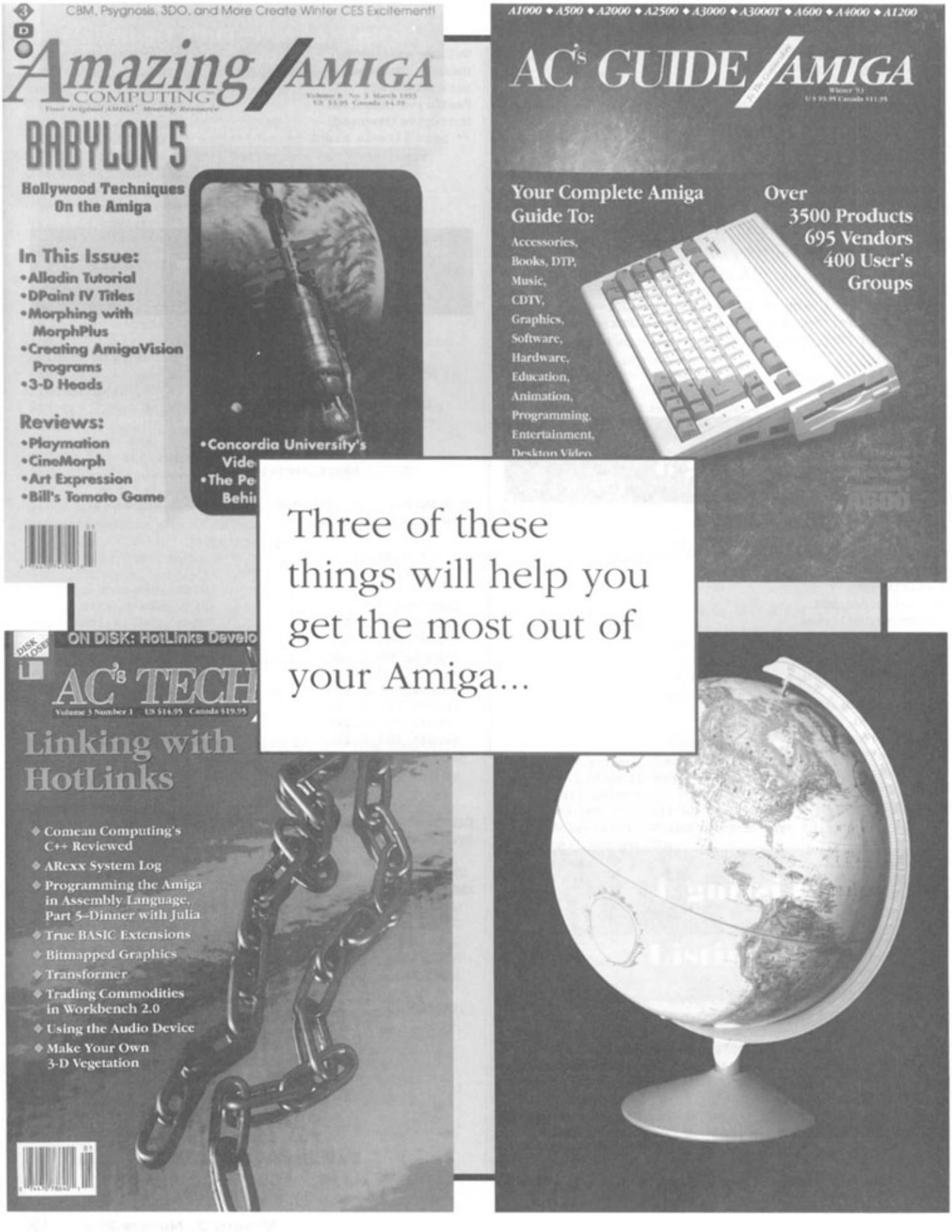
Listing 4

```
/* first line is blank for INFO command */Mounted disks:
Unit    Size   Used   Free Full Errs   Status   Name
MD1:    No disk present
MD0:    No disk present
RAM:    51K      51      0 100%   0  Read/Write RamDisk
DH0: 6908K   11521   2295  83%   0  Read/Write BootDrive
DF0:    No disk present
DF1:    No disk present
DH1:   28M   54030   3837  93%   0  Read/Write FastDrive
DH2:   14M   24375   6003  80%   0  Read/Write Work
Volumes available:
RamDisk [Mounted]
Work [Mounted]
FastDrive [Mounted]
BootDrive [Mounted]
/* last line is blank */
```

Listing 5

```
    Catalog File prepared on 24 Jan 1993.

     DISK #   Volume Name
     ------   -----------

        1      Quaterback_Reports:
        2      ARexx_Article_BU:

DISK Number 1, Volume Name -> Quaterback_Reports:
Free disk space 516K Kb

    DIR_Listing (dir)
      Dir_091291.lzh
  .info                          Disk.info
  Quarterback                    Quarterback.info
  Report_DH0_1.lzh               Report_DH0_2.lzh
  Report_DH0_3.lzh               Report_DH0_4.lzh
  Report_DH0_5.lzh               Report_DH0_6.lzh
  Report_DH0_7.lzh               Report_DH0_8.lzh
  Report_DH1_1.lzh               Report_DH1_2.lzh
  Report_DH1_3.lzh               Report_DH1_4.lzh
  Report_DH1_5.lzh               Report_DH2_1.lzh
  Report_DH2_2.lzh               Report_DH2_3.lzh
 Report_DH2_4.lzh


DISK Number 2, Volume Name -> ARexx_Article_BU:
Free disk space 705K Kb

 2WindowDemo.rexx
AMAZ_Article_ARexx_1.doc
 AMAZ_Article_ARexx_1.txt       Cataloger.info
 Cataloger.rexx                 CatalogPrint.rexx
 Listing_1                      Listing_2
 Listing_3                      Listing_4
 Listing_5                      Pictures.info

LISTING 5.
```

Please write to:
T. Darrel Westbrook
c/o AC's TECH
P.O. Box 2140
Fall River, MA 02722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◆ Using the Audio Device
◆ Make Your Own 3-D Vegetation

—Assembly *continued from page 23*

```
  movea.w #256,maxcount
   bra     no_message
do_set512
  movea.w #512,maxcount
   bra     no_message
do_set1024
  movea.w #1024,maxcount
   bra     no_message
zoom
   andi.l  #$0000ffff,d5       ;make mouseX a word
   andi.l  #$0000ffff,d6       ; and mouseY
   move.l  d5,startx           ;save them
   move.l  d6,starty
   move.l  startx,d0
   mode    complement          ;XOR color
lmb_down
   cfm     lmb1
;  cmpi.l  #mousebuttons,d2
;   bne.s   lmb_down
   cmpi.w  #selectup,d3        ;lmb must be up
   beq     lmb_up
lmb1
  andi.l  #$0000ffff,d5
  andi.l  #$0000ffff,d6
   move.l  d5,endx             ;save ending coordinates
   move.l  d6,endy
  box    startx,starty,endx,endy,5
   delay   1                   ;optional
  box    startx,starty,endx,endy,5
   bra     lmb_down
lmb_up
   mode    jam1                ;restore draw mode
   zmul    xscale,startx
   add.l   xc,d0
   move.l  d0,newxc            ;new xc

   zmul    xscale,endx
   add.l   xc,d0
   sub.l   newxc,d0
   fltdp
   movedp  d0,d6
   fltdp   320
   movedp  d0,d2
   movedp  d6,d0
   divdp
   fixdp                       ;new xscale
   tst.l   d0
   bne.s   new_xscale
   beep
   moveq   #1,d0               ;make it at least 1
new_xscale
  move.l  d0,xscale
  move.l  newxc,d0
  move.l  d0,xc

  move.l  yscale,d0
  moveq   #0,d1
  move.l  #200,d1
  sub.l   endy,d1
  move.w  d0,d2
  mulu    d1,d2
  swap    d0
  mulu    d1,d0
  swap    d0
   clr.w   d0
   add.l   d2,d0
   add.l   yc,d0
  move.l  d0,newyc

  move.l  yscale,d0
  moveq   #0,d1
  move.l  #200,d1
  sub.l   starty,d1
  move.w  d0,d2
  mulu    d1,d2
  swap    d0
  mulu    d1,d0
  swap    d0
  clr     d0
  add.l   d2,d0
  add.l   yc,d0
  sub.l   newyc,d0
  fltdp
  movedp  d0,d6
  fltdp   200
  movedp  d0,d2
  movedp  d6,d0
  divdp
  fixdp
  tst.l   d0
  bne.s   new_yscale
  beep
  moveq   #1,d0
new_yscale
  move.l  d0,yscale
  move.l  newyc,d0
  move.l  d0,yc
   bra     showit
no_message
   addq.w  #1,down             ;down one space
   cmpi.w  #200,down           ;all way down yet ?
   bne     ml2                 ;branch if not
finl
  move.l  xloc,d1
   add.l   xscale,d1           ;increase xloc by xscale
  move.l  d1,xloc
   addq.w  #1,across           ;over one space
   cmpi.w  #320,across         ;all way across yet ?
   bne     ml1                 ;branch if not
  bra    check_for_message

close_window
  closemenu
  closewindow
close_screen
  closescreen
close_libs
  closelib dpmath
close_gfx
  closelib gfx
close_dos
  closelib dos
close_int
  closelib int
done
  move.l  stack,sp
   rts

  evenpc

stack      dc.l  0             ;reserve storage loca-
```

```
tions
gfxbase     dc.l  0
intbase     dc.l  0
dosbase     dc.l  0
dpmathbase  dc.l  0
            even
                                ;library names
gfx         dc.b  'graphics.library',0
  evenpc
int         dc.b  'intuition.library',0
  evenpc
dos         dc.b  'dos.library',0
  evenpc
dpmath      dc.b 'mathieeedoubbas.library',0

myscreen:
  dc.w 0,0,320,200,depth        ;depth is 5
  dc.b 1,2
  dc.w 0
  dc.w customscreen
  dc.l 0,0,0,0
  evenpc
mywindow
  dc.w 0,0,320,200
  dc.b 31,13
  dc.l mousebuttons!menupick!mousemove
;IDCMP flags
  dc.l activate!smartrefresh!borderless!mousereport
;window flags
  dc.l gadget1,0
  dc.l 0
  dc.l 0,0
  dc.w 0,0,0,0
  dc.w customscreen
  evenpc
xc          dc.l  $c0000000         ;-2 * scale
newxc       dc.l  0
yc          dc.l  $c0000000
newyc       dc.l  0
xscale      dc.l  $00666666         ;(4 / 320) * scale
yscale      dc.l  $00a3d70a         ;(4 / 200) * scale
xloc        dc.l  0
yloc        dc.l  0
aloc        dc.l  0
bloc        dc.l  0
asqr        dc.l  0
asqr4       dc.l  0
bsqr        dc.l  0
bsqr4       dc.l  0
sum         dc.l  0
sum4        dc.l  0
diff        dc.l  0
diff4       dc.l  0
juliaa      dc.l  0
juliab      dc.l  0
startx      dc.l  0
starty      dc.l  0
endx        dc.l  0
endy        dc.l  0
across      dc.w  0
down        dc.w  0
sign        dc.w  0
julia       dc.w  0
  evenpc
colormap                        ;my new palette
  dc.w $000,$f0f,$d0f,$b0f,$90f,$70f,$50f,$d0f
  dc.w $10f,$00f,$03d,$05b,$079,$097,$0b5,$0d3
  dc.w $0f0,$3f0,$6f0,$9f0,$bf0,$df0,$ff0,$fe0
  dc.w $fd0,$fc0,$fa0,$f80,$f60,$f40,$f20,$f00
  evenpc
menus
  makemenu menu0,'Project',menu1,0,1
    makeitem
menu0item0,'Mandelbrot',menu0item1,0,$157,$2,'M'
    makeitem
menu0item1,'Julia_Set',menu0item2,10,$57,$1,'J'
    makeitem
menu0item2,'Coordinates',menu0item3,20,$56,,'C'
  makeitem menu0item3,'QUIT',,30,$56,,'Z'
  makemenu menu1,'Display',,90,1
    makeitem
menu1item0,'ItCount',,0,$52,,,menu1item0subitem0
    makesubitem
menu1item0subitem0,'64',menu1item0subitem1,0,$153,$1e
    makesubitem
menu1item0subitem1,'128',menu1item0subitem2,10,$53,$1d
    makesubitem
menu1item0subitem2,'256',menu1item0subitem3,20,$53,$1b
    makesubitem
menu1item0subitem3,'512',menu1item0subitem4,30,$53,$17
   makesubitem menu1item0subitem4,'1024',,40,$53,$f
gadgets
  makestrgadget
gadget1,'Xleft',gadget2,40,100,100,9,$0,$1,$0,1,15
  makestrgadget
gadget2,'Ytop',gadget3,110,75,100,9,$0,$1,$0,2,15
  makestrgadget
gadget3,'Xright',gadget4,180,100,100,9,$0,$1,$0,3,15
  makestrgadget
gadget4,'Ybot',gadget5,110,125,100,9,$0,$1,$0,4,15
  makestrgadget
gadget5,'JuliaA',gadget6,40,150,100,9,$0,$1,$0,5,15
  makestrgadget
gadget6,'JuliaB',,180,150,100,9,$0,$1,$0,6,15
  evenpc
gadget1buffer dc.b '-2.00000000000',0  ;default values
  evenpc
gadget2buffer dc.b '2.000000000000',0
  evenpc
gadget3buffer dc.b '2.000000000000',0
  evenpc
gadget4buffer dc.b '-2.00000000000',0
  evenpc
gadget5buffer dc.b '0.000000000000',0
  evenpc
gadget6buffer dc.b '0.000000000000',0
 end
```

Please Write to:
William P. Nee
c/o AC's TECH
P.O. Box 2140
Fall River, MA 02722-2140

—**OLE** *continued from page 13*

```
'
* see if hot spots are within 6. pick frontal image.
climb 50 lines slowly.
* this will remain constant regardless of cpu because of
implied vblanking.
* every second pixel of climb we will check will collision
with a bull.
* set climb flag. increment operations deck level #,
reset 'got prize' flag.
* note how we make assign bool expressions to r6 and r9,
then checking both
* in the same 'if' test. thus we save one jump, keeping
within the 3 to a
* loop limit!
'
O: Let R6=R7>6; Let R9=R7< -6; If R6|R9 J A; L A=7;
   F R0=1 T 25  L Y=Y-2; If BC(0,1,4) J P;  N R0;
   L R2=1; L RD=RD+1; L RL=0; J A;
'
* matador collided with bull. move him off screen. set
'gored' flag
'
P: F R0=1 To 15  L X=X-15; L Y=Y-15; N R0; L R2=0; L
R6=0; L R8=0;
  L R9=0; L RO=1; J A;


' chan 1 to bob 1
' bottomost bull
L X=15; L Y=196;
A: Anim 0,(4,9)(5,15);M 290,0,RA
Anim 0,(2,9)(3,15);M -290,0,RA
Jump A;


' chan 2 to bob 2
' 2nd bottom most bull
L X=304; L Y=146;
A: Anim 0,(2,9)(3,15);M -290,0,RA
Anim 0,(4,9)(5,15);M 290,0,RA
Jump A;


' chan 3 to bob 3
' 2nd from top bull
L X=15; L Y=96;
A: Anim 0,(4,9)(5,15);M 290,0,RA
Anim 0,(2,9)(3,15);M -290,0,RA
Jump A;


' chan 4 to bob 4
' topmost bull
L X=304; L Y=46;
A: Anim 0,(2,9)(3,15);M -290,0,RA
Anim 0,(4,9)(5,15);M 290,0,RA
Jump A;


' chan 5 to bob 5
' bottom prize
' assign value from setprizes procedure to this channel's
'x'
L X=RH;
' if collision permitted, check for one. else pause, and
retest flag.
A: If RL=0 J B; P; J A;
' if collision detected, set loop flag, and test for skill
level
B: If BC(5,0,0) J C; P; J A;
C:   L RL=1;
' set appropo prize image value. incr score per current
skill level
L A=RC+19; L R0=RC+1; L RM=R0*10+RM; J A;


' chan 6 to bob 6
' second prize from bottom
' assign value from setprizes procedure to this channel's
'x'
L X=RI;
' if collision permitted, check for one. else pause, and
retest flag.
A: If RL=0 J B; P; J A;
' if collision detected, set loop flag, and test for skill
level
B: If BC(6,0,0) J C; P; J A;
C:   L RL=1;
' set appropo prize image value. incr score per current
skill level
L A=RC+19; L R0=RC+1; L RM=R0*10+RM; J A;


' chan 7 to bob 7
' 2nd from top prize
' assign value from setprizes procedure to this channel's
'x'
L X=RJ;
' if collision permitted, check for one. else pause, and
retest flag.
A: If RL=0 J B; P; J A;
' if collision detected, set loop flag, and test for skill
level
B: If BC(7,0,0) J C; P; J A;
C:   L RL=1;
' set appropo prize image value. incr score per current
skill level
L A=RC+19; L R0=RC+1; L RM=R0*10+RM; J A;


' chan 8 to bob 8
' top prize
' assign value from setprizes procedure to this channel's
'x'
L X=RK;
' if collision permitted, check for one. else pause, and
retest flag.
```

```
A: If RL=0 J B; P; J A;
' if collision detected, set loop flag, and test for skill
level
B: If BC(8,0,0) J C; P; J A;
C:    L RL=1;
' set appropo prize image value.  incr score per current
skill level
L A=RC+19; L R0=RC+1; L RM=R0*10+RM; L RP=1; J A;
```

Listing Two

```
'
'  Ole.AMOS by T.J. Eshelman September 30, 1992
'                    after FastAmigo by John Gilmore
'  9 Skill Levels - Bulls go faster.  Matador goes
slower. 8-)
'
'
Load Iff "Ole/Title.pic",2
Load Iff "Ole/Ole.pic",0
Load "Ole/OleSprites.abk" : Rem Takes bank 1.
Load "Ole/OleAmal.abk" : Rem Takes bank 4.
Load "Ole/OleSamples.abk" : Rem Takes bank 5.
Load "Ole/OleMusic.abk" : Rem Takes bank 3.
Screen 2
Music 1
Auto View Off
'
Screen Open 1,320,200,16,Lowres
Screen Copy 0 To 1 : Rem For a background pic.
'
Get Sprite Palette : Flash Off : Hide : Double Buffer
Screen 0 : Rem Make this current
Fade 1 : Rem so we can fade it to black.
Screen 1
Synchro Off : Rem To detect collisions in AMAL strings.
'
Dim LAD(3) : Rem Horizontal coords for 3 ladders
Dim PRIZE(4) : Rem Horizontal coords for the prizes.
'
' All bobs being assigned an AMAL channel must first be
referenced.
' Bobs 1,2,3,4 are the bulls, bottom deck to top.
' Bobs 5,6,7,8 are the prizes, bottom deck to top.  See
Proc SETPRIZES
'
Bob 0,250,250,6 : Rem Matador.  All these drawn off screen
to start with.
Bob 1,15,296,2 : Bob 2,304,246,2 : Bob 3,15,296,2 : Bob
4,304,246,2
Bob 5,250,250,10 : Bob 6,260,260,10 : Bob 7,270,270,10 :
Bob 8,280,280,10
'
'Bobs 9,10,11 are the ladders, bottom deck to top.  See
Proc SETLADDERS
'Bobs 12,13,14,15 are the Remaining Matadors icons. See
Proc SETICONS
'
Channel 0 To Bob 0 : Channel 1 To Bob 1 : Channel 2 To Bob
2
Channel 3 To Bob 3 : Channel 4 To Bob 4 : Channel 5 To Bob
5
Channel 6 To Bob 6 : Channel 7 To Bob 7 : Channel 8 To Bob
8
'
' RA=BULL SPEED.  RC=Skill level (0-8).  RD=Operations
deck (0-3).
' RE, RF, RG are ladder X's.  RH, RI, RJ, RK are prize
X's.
' RL=Got prize flag.  RM=Score.  RN=MATADOR SPEED.
RO=Gored flag.
' RP=4th Level done flag  RQ=Jumping delay time.
RR=Score increase.
'
'              Image Nos. for prizes at each of the 9
levels.
'
'  BAG=10 : BALLOON=11 : SHADES=12 : CONE=13 : CANNON=14
'  BEER=15 : LOCO=16 : HOTDOG=17 : WHISKEY=18
'
'              Sound File Sample Numerical Equivalents
'
BOING=1 : CROWD=2 : GLASS=3 : HIGH=4 : HORN=5 : LAUGH=6 :
OK=7 : PRIZE=8 : YELL=9
'
'  Here follows the "main()" program.
'  These instructions are given once and done when game
begins.
'
Ink 4,5
Text 2,9,"Ole! Amos 1.0"
Amal 0,0 : Amal 5,5 : Amal 6,6 : Amal 7,7 : Amal 8,8 : Rem
Like Amal 8,E$
Amal On : Rem Bulls under program control so as to always
start at edges.
Proc SETICONS : Rem Little faces in the title bar.
Volume 63
Amreg(Asc("D")-65)=0 : Rem Reset current ladder X.
Amreg(Asc("L")-65)=0 : Rem Reset 'got prize' flag
Amreg(Asc("M")-65)=0 : Rem Reset scoreboard
Amreg(Asc("O")-65)=0 : Rem Reset 'gored' flag.
Amreg(Asc("R")-65)=0 : Rem Reset 'scored' flag.
Text 220,9,"SCORE 0"
A=5 : Rem user gets 5 lives to lose.
'
' Anim channels can be assigned only to currently-existing
bobs.  Draw
' the bulls, prizes and man 'off screen' to avoid prema-
ture displays.
' To be sure our bulls always start from the edges of the
display, we turn
' their channels off, restarting them each 'gore' or new
level.  This means
' reexecution from the first line of code where X is set
at the display edges.
' The matador is handled similarly to help avoid 'colli-
sions' on resets.
'
Wait 1000
Music Off
Auto View On : Rem Blackened screen 0 is front and 'vis-
ible'.
For B=0 To 8 : Rem 9 skill levels.
  Amal Off 0 : Amal Off 1 : Amal Off 2 : Amal Off 3 :
Amal Off 4
  Screen To Back : Rem Put current screen (1) behind.
```

```
Pop screen 0 front.
  Screen 0 : Rem Make screen 0 current.
  Ink 4,1 : Rem print blue on tan Bg.
 Text 52,125,"Press Fire Button When Ready"
  Fade 5 To -1 : Rem Flush screen 0 with color.
  Wait 80 : Rem Give it a chance to flush.
  Sam Play $3,OK
   Do
     Wait Vbl
    If Fire(1) Then Exit
  Loop
  Fade 4 : Wait 80 : Rem Fade screen 0 to black.
  Auto View Off : Rem Turn off display while we draw and
flip.
  Screen 1 : Rem Make hidden screen current.  We draw our
bobs on it!
  Fade 2 To -1 : Rem Flush hidden Screen 1 with sprite
Colors
  Wait 30 : Rem Must allow flush time, or color transi-
tions incomplete.
  Ink 1,1 : Rem 'erases' text by printing tan on tan.
   Text 52,125,"                              "
  Ink 4,5 : Rem back to blue on white for scoring in the
title bar.
  Amal 0,0 : Amal 1,1 : Amal 2,2 : Amal 3,3 : Amal 4,4 :
Rem Must first reassign
  Amal On 0 : Amal On 1 : Amal On 2 : Amal On 3 : Amal On
4
 Amreg(Asc("C")-65)=B : Rem Inform AMAL scorekeeper of
current skill level
'
 SPEED=(120-(B*9)) : Rem Determined empirically by
author's 'reflexes' 8-)
 Amreg(Asc("A")-65)=SPEED : Rem Bull time 120-48 in
increments of 12
'
 If SPEED>100
  Amreg(Asc("Q")-65)=SPEED/10 : Rem Jumper's pause
inverse propo to speed
 Else Amreg(Asc("Q")-65)=1 : Rem But pausing 'kills' at
higher speeds.
  End If
'
 MANSPEED=(11-B)/2
 If MANSPEED<2
    MANSPEED=2
 End If
 Amreg(Asc("N")-65)=MANSPEED : Rem Man slows 6-2 thus -
5 5 4 4 3 3 2 2 2
'
 Proc SETLADDERS : Rem provide for random distribution
of bobs
 Proc SETPRIZES[B+10]
 Proc SETMATADOR
 Screen To Front : Rem Bring current screen (1) front.
 Screen 0 : Rem Quickly bleach screen 0 for future fade
in's.
  Fade 1
 Screen 1 : Rem screen 1 current again.
 Auto View On : Rem Let's see it!'
  Do
   Synchro : Rem Gives each of our AMAL channels a
'shot'
    Wait Vbl
    '
   If Amreg(Asc("O")-65)=1 : Rem We've been 'gored'
      Sam Play $F,BOING
       Wait 50
      Bob Off A+10 : Rem Erase an icon
      Dec A : Dec B : Rem Lose one life.  Skill level
restored on loop.
     Amreg(Asc("O")-65)=0 : Rem Reset 'gored' flag
      Sam Play $F,YELL
      If A<1 : Rem No more lives
         Exit
       End If
       Fade 10
       Wait 100
      Sam Play $F,GLASS
       Wait 100
       Exit
    End If
    '
  If Amreg(Asc("R")-65)<>Amreg(Asc("M")-65)
      Sam Play $F,PRIZE
    Text 220,9,"SCORE"+Str$(Amreg(Asc("M")-65))
    Amreg(Asc("R")-65)=Amreg(Asc("M")-65)
    End If
    '
   If Amreg(Asc("P")-65)=1 : Rem Ready for next skill
level.
     Amreg(Asc("P")-65)=0 : Rem Reset 4th level flag,
and reloop.
      Sam Play $5,HORN
      Sam Play $A,CROWD
       Wait 50
       Fade 10
       Wait 200
       Exit
    End If
'
  Loop
  '
 If A<1 : Rem Out of lives (icons)
   B=10 : Rem Cause B to exceed its bounds.
 End If
```

```
'
   If B=8
     Sam Play $F,HIGH
     Wait 50
     Sam Play $5,HORN
     Sam Play $A,CROWD
     Fade 15
     Wait 225
     End
   End If
Next B
Sam Play $A,LAUGH
Wait 50
Sam Play $F,LAUGH
Fade 15
Wait 225
'
End
'
Procedure SETLADDERS
  Shared LAD()
  B=196
  For A=0 To 2
    '                          Ladders legal: X = 12-308.
Y = 96,146 & 196.
    LAD(A)=Rnd(296)+12
    Amreg(A+4)=LAD(A) : Rem Assign ladder x's to RE, RF,
RG.
    Bob A+9,LAD(A),B-(A*50),1 : Rem Trick allows assign-
ing bottom upward
  Next A
 Amreg(Asc("D")-65)=0 : Rem Reset channel 0 ladder climb
coordinate
End Proc
Procedure SETPRIZES[LEVEL]
  Shared PRIZE()
  B=196
  For A=0 To 3
    PRIZE(A)=Rnd(296)+8
    Amreg(A+7)=PRIZE(A)
   Bob A+5,PRIZE(A),B-(A*50),LEVEL
  Next A
 Amreg(Asc("L")-65)=0 : Rem Reset 'got prize' flag
End Proc
Procedure SETICONS
  For A=0 To 3
    Bob A+12,(A*14)+120,2,9
  Next A
End Proc
Procedure SETMATADOR
 Bob 0,160,196,6 : Rem For completeness. Respots the
bob consistently.
End Proc
```

Please write to:
Thomas J. Eshelman
c/o AC's TECH
P.O. Box 2140
Fall River, MA 02722

—BTree *continued from page 31*

```
showrec.o: showrec.c $(HEADERS)
    $(CC) $(FLAGS)    showrec.c

upindex.o: upindex.c $(HEADERS)
    $(CC) $(FLAGS)    upindex.c

mkkey.o: mkkey.c $(HEADERS)
    $(CC) $(FLAGS)    mkkey.c

opendb.o: opendb.c $(HEADERS)
    $(CC) $(FLAGS)    opendb.c

closedb.o: closedb.c $(HEADERS)
    $(CC) $(FLAGS)    closedb.c

filename.o: filename.c $(HEADERS)
    $(CC) $(FLAGS)    filename.c

chgextnt.o: chgextnt.c $(HEADERS)
    $(CC) $(FLAGS)    chgextnt.c

flushdb.o: flushdb.c $(HEADERS)
    $(CC) $(FLAGS)    flushdb.c

# Removed getdisk.o and getcurdr.o for
AMIGA conversion
# getdisk.o: getdisk.c $(HEADERS)
#    $(CC) $(FLAGS)    getdisk.c

# getcurdr.o: getcurdr.c $(HEADERS)
```

Please write to:
John Bushkara
c/o
AC's TECH
P.O. Box 2140
Fall River, MA 02722-2140

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```
      next w
   else
      plot text, at X + LM, Y : String$
                ! USING XSPECS OR HIRES & INTERLACE?
      ! TRY DOUBLE PRINTING TO KILL FLICKER.
      if YOff <> 0 then
         plot text, at  X + LM, Y + YOFF : String$
      end if
   end if
end sub
```

You do not just show an image. You call a sub whose job it is to show images at a place you desire. This sub may have its own independent work to do. Let the image subs worry about the image details. Do not burden the text subs with image overhead. Do not mix jobs. First plot the image in the desired place by passing the buck to an image routine.

If you map the space available to text, line by line in terms of the total space minus that taken up by an image, then you have in these two main subs just about everything you need for word wrap around images.

Now all that is needed is a sub to place an image within a requested location, determine the left and right boundaries available to text as we go from top to bottom, and to call the parse routine to get that amount of text that will fit each line and then the justify routine to plot it according to the rules we picked, line by line, top to bottom.

At the end of each stopping point (bottom of page or form feed etc.) call for an image update from the image routine. That is, always pause in image mode. If that image plotting routine can detect mouse and key presses (if so enabled) then it can report those it does not understand back to the caller and act on those it does understand.

Our image engine knows what to do with arrow key presses as well as a variety of 'play' command key presses. If that image happens to hold 16 frames, then we can play it or step through it at will and still return text scrolling key presses back to the caller sub.

Oh yeah. The image plotting sub should take notes as to what image it was on and what was pressed and what point the mouse was pointing at. Maybe the caller sub can use that information. Can't hurt. It would be wise to give the caller sub the ability to disable or enable some of the image handling features. Pass a key.

Problem: The picture image nearly always dictates the color palette. How can we possibly figure, in advance, with hundreds of pictures to load, that text will show up well against the backdrop color and that it won't go nuts in a HAM environment even when we label details within the HAM image?

Let's look a one solution but first consider two.
We need to place an image, then define from top to bottom how many lines there are and the left and right bounds of each line. Two main ways exist. First, just start at the top and figure each line as you go looking at the bottom margin to be sure not to go to far. The included sub works this way. It sets an upper zone left and right and a lower zone left and right. When the image is placed, those values get set. We could use an alternate method of setting up an array to hold the left and right limits and the vertical position of the line. This latter method is fast, but carries the array overhead which isn't bad. The array method would allow columns of text and central placement of images. The text printing would merely stay within the array limit set for that page. The latter was not used for no good reason. It was determined,

```
  Def SwapChar$(S$,CH1$,CH2$)
      if CH1$ <> CH2$ then
        let T$ = ""
        do while pos(S$,CH1$) > 0
          let T$ = T$ & Before$(S$,CH1$) & CH2$
          let S$ = After$(S$,CH1$)
        loop
        let SwapChar$ = T$ & S$
      else
        let SwapChar$ = S$
      end if
   end def
end sub

! 'NoTabs'  Do Program
! Strip tabs out of 'C' code and -> 3 spaces each.
! The usual 'C' editors use tabs alot. I prefer spaces.
! I can do better code conversions with all spaces.
          EXTERNAL
          SUB NoTab_DO(line$(), arg$)
             FOR i = 1 to UBound(line$)
       LET p = pos(line$(i),CHR$(9))
       IF p > 0 then
          DO while p > 0
            LET line$(i)[p:p] = "   "
            LET p = pos(line$(i),CHR$(9))
          LOOP
       END IF
    NEXT i
          END SUB

! 'Ask_dir'
! ABSTRACT:  Reports the name of the current directory
! in the command window. Will echo if ECHO is activated.
! The compiled version is 'AskDir' is in the TBDo drawer.
          ! SYNTAX:    DO AskDir
          EXTERNAL
          sub Ask_Dir(line$(),arg$) ! arg$ is ignored.
   Library "{Toolkit}highdos*"
   Library "{AmigaTools}dos*"
   Library "{AmigaTools}amiga*"
             call askdir(dirname$)
   cause error 1, "Directory is " & dirname$
end sub
```

Notice that a 'cause error' is used to break out of the sub and creates an err string. Err strings are automatically reported in the command window. That's cheap. I know. But, this is a very easy way to get short informational text to the command window.

```
! 'Change_dir'
! ABSTRACT: Changes & reports the name
!          of the current directory.
! Saved as compiled code 'ChangeDir' in the TBDo directory.
! SYNTAX:    DO ChangeDir, "New Directory Name"
          EXTERNAL
          sub Change_Directory(line$(),NewName$)
   Library "{Toolkit}highdos*"
   Library "{AmigaTools}dos*"
   Library "{AmigaTools}amiga*"
             if NewName$ = "" then
      cause error 1, "Use: Do CD, pathname"
   end if
             call askdir(OldName$)
             when error in
        call Chdir(NewName$)
   use
      cause error 1, Extext$ & " Dir=" & OldName$
   end when
             cause error 1, "Directory is " & NewName$
end sub
```

Here, the same strategies are used. An error trap 'When error in' is used to trap an error to allow formation of a meaningful message. 'Extext$' is a True BASIC string that can be checked at any time. It contains "" or text relating to a trapped error by True BASIC. Here we put the error text out, as is, but with additional information concatenated (&).

```
! "ShellLib_Do"
! The compiled version is saved as 'Shell' in the
```

however to use a method which would be most suited to HAM images and avoiding fringing without repair work, and to handle XSpecs images which demand very careful vertical tracking and need text vertical offset double printing to eliminate eye destroying flicker (worse than interlace alone).

Here is what we do. Place the image in any of four corner positions. Plot a frame around it if the image carries such a flag or if requested by the caller (This frame is the simplest way to kill fringing in HAM). Set colors to that requested by the caller but allow the caller to defer to color choices encoded in the image itself. Invisibly, the image has encoded information which tells all subs what text and background color combinations work best, whether the image is 3-D, what frame color is best, and other optional goodies.

After placing the image, start the top and lay down one line of text at a time, hyphenating and justifying according to flags set. At text end or window bottom stop and replot the image in an image control sub. That sub waits for mouse click or key press. If the input is image control it does what is asked. If it is unfamiliar, it returns to the text wrapping sub. If the text wrapping sub does not recognize the key press it returns to the image control sub. Round and round we go if strange key presses are given. However, if the key press indicates forward or backward text scroll, then tracking pointers to the text are used to replot the window text and pause again in the image control sub.

The text wrap sub does more than blindly print the parsed text. It reads the text for key words and control sequences. These words can bring up a text input requester with a message such as a question. The text input from the user is stored in an answer text array to be passed back to the main program on conclusion of the sub activity. That array also carries data indicating where the mouse was pointing and what frame of the image was shown at the time of the answer.

Because each frame can be a unique image, and because each frame can encode data about itself it is easy to show a series of ANIMal images and ask "Point to a duck's bill." If the duck is image #5 and the x,y image pixel coordinates are within the set tolerance of the embedded coordinates (or color) for "Duck bill", then the program knows that the answer was correct. The program need not even know about ducks, their bills, anything specific, just that the point and click matched the query.

In normal use you do not call this sub directly, but call others with easier names which in turn call this one, setting most of the flags and values for you. Either way, here is a breakdown of the many arguments to this sub before we dissect the sub itself:

```
    sub WrapTextBoxQueryANIM(Brush$(), S$,TextLF$,TextFF$,
  TextHue,BackHue, WindowFrame,BrushFrameHue,Quad,
  HyphPct,JustPct,Margins,LineSpacing,
  L,R,B,T,REPAIR, LookupTable(), kk, Response$())
        library "TBL:ScreenModeLib.OBJ" ! Resource statement.
```

This sub calls another library to do some of its work. The structure of "intelligent images", images with nonimage embedded data, is handled by ScreenModeLib.

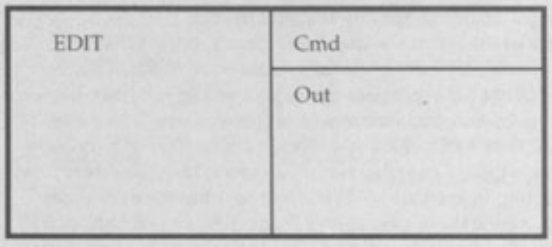
This is the big one that the others call to do their work. If you must control specific aspects of the function, then use this call. Most of the

```
! TBDo drawer. Rather than click back and forth for
! file management, use an Amiga shell. Type 'do Shell'
! in the command window. An Amiga shell pops up.
! Requires dos*, amiga*
        EXTERNAL
sub DO_Shell(Line$(), arg$)
   call Shell("")
end sub

sub  Shell(s$)
    library "(AmigaTools)dos*"
    library "(AmigaTools)amiga*"
            declare def Open, Execute, Close
    declare def Addr
            let MODE_NEWFILE        = 1006
    let MAXSTRINGLENGTH     = 512
    let inhandle, outhandle = 0
            ! Open a console window:
    let n$ = "NewShell" & CHR$(0)
    let ptrString1 = Addr(n$)
            let inhandle = Open(ptrString1, MODE_NEWFILE)
    if  inhandle = 0 then exit sub
            let xxx = Execute(ptrString1,inhandle,outhandle)
    let outhandle = 0 ! Already closed by user.

    if inhandle  <> 0 then let xxx = Close(inhandle)
    if outhandle <> 0 then let xxx = Close(outhandle)
end sub

An easy one:
        EXTERNAL
sub DO_UpdateFile(Line$(), arg$)
   ! first use two True BASIC strings supplied by system:
   let dt$ = Date$ & " " & Time$
           for i = 1 to min(30, Ubound(line$))
      let p =  pos(UCASE$(line$(i)), "REVISION =")
               if  p > 0 then
         ! Trim off old time stamp
         let line$(i)[p +10 : MAXNUM] = ""
                 ! Append new time stamp
         let line$(i)[MAXNUM:0] = dt$
         exit for
      end if
   next i
end sub
```

Notice that any number bigger than the string length, in string notation brackets, means 'after the last character'. The notation let s$[0:0] = "A" would insert an 'A' into the string "BCDEF" as "ABCDEF". When updating complex files it is handy to keep track of the date so as to avoid later confusion for small, hard-to-find changes. Here, 'do update' would update the date and time stamp in your remarks at the top of the file (up to 30 lines before giving up) if the compiled code were saved as 'Update' in the TBDo drawer.

Get it?

One last cute trick. Open and size the command, edit, and output windows as all visible:



Enter this code in the Edit window:

```
        for i = 1 to 5
   print "A = "; i
next i
        end
```

Now run it. The output is as you would expect.

details of function are handled by defaults. If the defaults bug you, call this sub direct.

Brush$() Any True BASIC brush (any mode, simple, ANIM &/or 3-D). A null string ("") may be used. You had best supply color choices unless the defaults are OK, as there is no color information in a null string. Use image as an array even if it is a single image. You get big speed and memory savings that way.

S$ Text to wrap around the brush. Any length, can be many pages.

TextLF$,TextFF$ Optional user special text embedded line and form feed sequences. Can be null as the sub uses defaults.

TextHue,TextBackHue,BrushFrameHue as before. -1 uses values in Brush$, if none -> general defaults if color information is not passed by the arguments and is not found in the brush itself, then general defaults are used:

```
default background color is 0
        text = 1
        window frame = 3
        brush frame = none.
```

WindowFrame color to frame display area. -1 = defaults to color 3

Quad = Quadrant to show brush in. Err resets the value = 1. 1 = left upper, 2 = right upper, 3 = left lower, 4 = right lower

HyphPct, JustPct, Margins(in chars) as above. But, if using the query function to return line and char position of mouse click, then turn justification off (JustPct = 0). Otherwise the x value (char) might be off.

Now edit print "A = " to be "B = " and rerun it.
Note that the output window, under 2.0, acts like a shell and appends this output to the last without erasing the last output.

Now in the command window type:
'plot text, at .1,.5: "hello"'
That text appears in the output window as expected.
place this same line after the for-next loop in the edit window as

```
        ...
next i
        plot text, at .1,.5: "hello"
        end
```

Now when you run it, the output window clears each time. The presence of encoded graphic plot commands creates a clean graphic window each time. The 'forget' command also wipes the slate clean. However, 'forget' also unloads any loaded libraries.

You can take this several ways. Easily frustrated, "What am I supposed to do with all these options?" Answer. Nothing. They are invisible. If I did not tell you about them, you would not have known they were there. Lover of adventure, "Are there others?". Answer. Yes, but if I tell you, then I kill all the fun. Hard core hacker,"What else is really super weird that I can play with?" Answer, Several (adventure lover, stop reading immediately). Well for one thing the editor can load byte files, nibble them and resave them. Yes, True BASIC can load True BASIC and edit True BASIC. Some of the features in True BASIC were typed directly into the compiled code from the True BASIC editor. Can you guess which ones? Can you figure how to use 'do' programs with this tidbit?—RN

LineSpacing = space between lines.

L,R,B,T The rectangle within the current active window to use for this pop-up text and image box.

REPAIR -1 Leave screen as is when done. What ever was there stays there.
0 = same
1+ Repair the L,R,B,T rectangle with what was there before this sub was called (creates a pop-up box). Any value > 0 will elicit repair.

For memory management ease:
-2 or 2 Kill text (source string -> null) on exit.
-3 or 3 Kill text and brush (both ->null) on exit.

LookupTable() This array carries data about the brush$ to this sub AND carries data about user interaction with the text and image back to the caller. It lets the caller know which was the frame in an ANIM which was last seen (selected?), and what color the mouse was pointing to when it was clicked (any key that exits actually), and how the exit was elicited (which key, including function keys). 14 parameters are tracked.

Some of the 'front end' subs create and decode this lookup table array into more clear terms specific to the name and intent of the front end sub. Keeping this table intact, however, allows other subs to set and examine the table for complicated control uses.

KeyOrdOut The ord of the keypress that exits the sub (also logged into the lookup table so that several tables will keep the brush data clear but allow a key track as well). If you exit by way of an allowed function key, that key ord is duplicated here (also in the lookup table).

Response$() Response$ is an array that is ignored unless the input text contains certain keywords. The main key word is to start a new line of printed text:

```
blah blah\.PROMPT.12~◊This is a prompt\blah blah blah...
    Here
.PROMPT.12~◊This is a prompt.
```

.PROMPT. must be in caps, it triggers recognition of a request for a user typed input. It causes a prompt box requester to appear at the window bottom.

The 12~could be any number, but represents the maximum length string the user can type in. Input terminates automatically at that number. A '1~' would allow a single key press. The tilde is needed to terminate the number.

If no number is requested:

```
blah blah\.PROMPT.This is a prompt\blah blah blah...
Then the string will be as long as space allows. A brush
image in quadrant 1 or 2 allows more text space for
the requester than if it were in quad 3 or 4.
```

For string input, the mouse click is identical to a carriage return <cr>. A mouse click alone, with no typed text, returns an empty string.

The alt-x (note that alternate-x is '◊' and not 'x'. This is optional. If present, the x and y values of the mouse cursor and which brush frame are tacked onto the string. These values are in terms of

x=char number and
y=line number.

If x=5,y=10 this means that the fifth character from the left on the 10th line was clicked.

The response string is returned as "text" if no alt-x was present, or as "text\" & Str$(x) & "\" & Str$(y) & "\" & Str$(frame) and might look like:

"My choice is\17\9\6" The backslash parses the parts. A counter is active which prevents a user query from being repeated if the help key is pressed to review prior text. Therefore, text can have any number of requests for input. The Response$() array is redimensioned to equal the number of questions asked.

About the third addition to the returned string:

"My choice is\17\9\2"
this———^

This third number is the frame count active at the time the answer was given. If this was a 7 part ANIM, the 2 means that this question was answered with the 2nd frame showing. The mouse pointer was on the 17th character in the 9th printed line of text. A string returned as "\17\9\2" means that the user just pointed and clicked with no text input.

Control keys: The PollANIM() sub in ScreenModeLib controls the display. Arrow keys step through ANIMs if the brush happens to be an ANIM. <- steps reverse, -> steps forward, <- and -> cycle to other end if end is reached.
The up & down arrows are the same. They step in the current direction until the end of the ANIM then reverse direction (back & forth). Ping pong.

Shift<- resets the ANIM to frame 1.

Shift-> goes to last frame.

P or p plays the ANIM and returns to whatever frame was last seen. It is most pleasing to do a shift-> before p so that the ANIM comes to rest on the last frame.

Keys 0 to 9 are also play keys. They slow the play down the higher the number (.1 to 1 sec).

Keys B and b play also but backward. Try Shift<- first. <esc> and <.> exit the display immediately.

Other keys scroll the text.
<HELP> key goes back 1 text page. You can back all the way to the beginning (limit 30 pages).

You can lock a specific frame of an ANIM as a single image that cannot be polled (played fwd or back). Set LookupTable(0) = -1. The image logged by LookupTable(-10) will be used as a single image. This requires that you set up the look up table array before you call these subs as these subs also will do it if not already done. They default to the entire ANIM unless this flag is set.

Here is the actual subroutine code:

```
sub WrapTextBoxQueryANIM(Brush$(), SS$, TextLF$, TextFF$,
 TextHue, BackHue, WindowFrame, BrushFrameHue, Quad,
 HyphPct, JustPct, Margins, Leading, WL,WR,WB,WT,
 REPAIR, ANIMPtrs(), kk, Response$())
          library "TBL:ScreenModeLib.OBJ"
          declare def SpanCharsFast,TBYPixel, TBXPixel
declare def PolarCharWidth, PolarCharHt
          dim TrackPage(30)        ! Can backtrack 30 pages.
dim MasterResponse$(30)  ! Track Q & A on ea. pg.
let MRPtr = 0            ! Count responses to Q&A.
dim LFA$(0:5)            ! Line feed etc. array
          mat Response$ = Nul$(1)  ! Ans array, redim later
          ! SAVE SCREEN AREA FOR LATER REPAIR IF REPAIR DESIRED:
if REPAIR > 0 then BOX KEEP WL,WR,WB,WT in UNDO$
          ! Default LF & FF's
user
call SetLineFeedArray(LFA$,TextLF$,TextFF$)
          ask color hue
if Ucase$(SS$[1:9]) = "NODOUBLE\" then
   ! Explicit TURN OFF
   ! Suppress XSpecs doubled text printing:
   ! if using a disk font which doesn't need it
   let S$ = SS$[10:MAXNUM]
   let NODOUBLE = 1
else
   let S$ = SS$
   let NODOUBLE = 0
end if
          let StLen = len(SS$)
let TP, KillBrush, ReNullify = 0

let TBx = TBXPixel !  defs, declared above
let TBy = TBYPixel !  which return the val of 1 pixel
                   ! in current window terms.
          WHEN ERROR IN
  call InitANIMPointersIfNeeded(Brush$, ANIMPtrs)
            let LbABr = Lbound(Brush$)
   let UbABr = Ubound(Brush$)
             if Brush$(ANIMPtrs(ANIMPtrs(-10))) = "" then
     ! Maybe a dummy frame in a valid ANIM
     box keep WL, WL + TBx, WB, WB + TBy in
                Brush$(ANIMPtrs(ANIMPtrs(-10)))
     if UbABr = LbABr then let KillBrush = 1
     let ReNullify = ANIMPtrs(ANIMPtrs(-10)) +.1
   end if
          USE
   ! A Dummy Brush
   ! mat redim's array, nul$ -> ""'s
   mat Brush$ = Nul$(1:1)
   ! one pixel brush
   box keep WL, WL + TBx, WB, WB + TBy in Brush$(1)
  call InitANIMPointersIfNeeded(Brush$, ANIMPtrs)
   let KillBrush = 1
END WHEN
          ! HOW BIG IS THIS BRUSH IN CURRENT WINDOW TERMS?
call TBABrushSize(Brush$,ANIMPtrs(ANIMPtrs(-10)),
     ImageXwd,ImageYht)
if abs(ImageXwd) => abs(WR-WL) then
   plot text, at WL, (WB+WT)/2 : "BRUSH TOO WIDE."
   call SMLHoldit(kk)
   exit sub
end if
          ! GET BRUSH EMBEDDED COLOR DATA or -1's if none.
call BrushOptionsFromBrush(Brush$,LbABr,THue,BHue,
                           BFrHue,ignore)

! THREE COLOR CHOICES: USER ARGUMENT TO THIS SUB,
! BRUSH EMBEDDED, OR BLIND DEFAULTS IF NEITHER SUPPLIED:
!       choice #  1       2       default:  Use:
call DefaultColor(TextHue,THue,          1, UTextHue)
call DefaultColor(BackHue,BHue,          0, UBackHue)
call DefaultColor(BrushFrameHue,BFrHue,-1, UBrushFrameHue)
call DefaultColor(WindowFrame,BFrHue,   3, UWindowFrame)
          call ResetANIMPointerColors(ANIMPtrs,UTextHue,UBackHue,
     UBrushFrameHue,-1)

 let Chw    = PolarCharWidth ! declared def above
 let ChH    = PolarCharHt    !  " correct even if diskfont
          let TMar   = WT - ChH * 1.2 ! Pleasing margins for text
 let BMar   = WB + ChH * 1.3 ! top & bottom
          if Leading < 0 then        ! Default line spacing.
   let LineHt = ChH * 1.3
 else
   let LineHt = ChH * max(Leading,1)
 end if
          let direction = sgn(WB-WT)  ! Rightward can be negative
 let LineHt = abs(LineHt) * direction

 ! NOW SET THE ACTUAL LIMITS FOR PRINTING MINUS MARGINS
 ! & IMAGE SPACE
 let MarginTrim = max(Margins,1)
 let MarginTrim = MarginTrim * Chw
          let UL, LL = WL + TBx
 let UR, LR = WR - TBx
 let EWT = WT - TBy
```

```
let EWB = WB + TBy
          Select case Quad
 case 2
      let ImX   = WR  - ImageXwd + TBx
      let ImY   = WT  - ImageYht + TBy
      let UR    = ImX - TBx
      let MidY  = ImY - TBy
      let AtTop = ChH
           case 3
      let ImX   = WL
      let ImY   = WB
      let LL    = ImX + ImageXwd + TBx
      let MidY  = ImY + ImageYht
      let AtTop = 0
           case 4
      let ImX   = WR  - ImageXwd + TBx
      let ImY   = WB
      let LR    = ImX - TBx
      let MidY  = ImY + ImageYht
      let AtTop = 0
           case else
      let Quad  = 1
      let ImX   = WL
      let ImY   = WT  - ImageYht + TBy
      let UL    = ImX + ImageXwd + TBx
      let MidY  = ImY - TBy
      let AtTop = ChH
          End Select
let MidTest = abs(WT -MidY +AtTop)
           ! HOLD SOME VALUES OF THE LOOKUP TABLE
! FOR LATER RESET ON EXIT
let Hold9 = ANIMPtrs(-9)
if ANIMPtrs(-9) <> 0 then
   if Quad < 3 then
     let ANIMPtrs(-9) = -sgn(ChH) * abs(ANIMPtrs(-9))
   end if
end if
let ANIMPtrs(-9) = ANIMPtrs(-9) * NODOUBLE
           ! OK, BEGIN.
! Show image.
! Then loop: print text page -> end on image reshow -,
!          '-------------------'
          call ClearPage_SetToTop
call ShowAnANIMFrame(Brush$,ImX,ImY,ANIMPtrs,ANIMPtrs(-10))
          DO
    if TP < 30 then let TP = TP + 1
    let TrackPage(TP) = StLen - len(S$) +1
              ! PAGE OF TEXT:
    do
     if  sgn(BMar -Y) <> direction then exit do
     if BottomIsSet = 0 and abs(WT-Y) > MidTest then
        call SetBottomOfPage
     end if

    call ParseText0(S$,LFA$,SpCh,HyphPct,WasLFFF,
         Fragment$)

     if Fragment$[1:8] = ".PROMPT." then
        if UsedQuerry < (STlen -len(S$)) then
          call GetUserResponse(Fragment$[9:MAXNUM])
          let UsedQuerry = Max(UsedQuerry, (STlen
                          -len(S$)))
        end if
     else
       call  PlotJustifiedBox(Fragment$, X1,Y,
             ANIMPtrs(-9), ChW,X2,JustPct,0)
       let Y = Y + LineHt
     end if
    loop while S$ <> "" and WasLFFF < 4 ! 4+ = form feed
              ! IMAGE SHOW & CONTROL:
   call PollANIMs(Brush$,ImX,ImY,ANIMPtrs,kk)
    if kk = 27 or kk = 46 then exit do
              if kk = 325 then ! Help Key -> Backup 1 page.
      let S$ = SS$[TrackPage(max(1,TP-1)) : MAXNUM]
      let TP = max(0, TP-2)
    end if
              if s$ <> "" then call ClearPage_SetToTop
 LOOP while s$ <> ""
          ! DONE. Clean up before going home.
set color hue
let ANIMPtrs(-9)  = Hold9
if REPAIR > 0 then BOX SHOW UNDO$ at WL,WB
let Undo$ = ""
if abs(REPAIR) > 1 then let SS$ = ""
if ReNullify  <> 0 then let Brush$(Round(ReNullify)) = ""
if abs(REPAIR) > 2 or KillBrush = 1 then
  mat Brush$  = NUL$(1:1)
end if
if MRPtr > 0 then
  ! THERE ARE RESPONSES. REDIM ANSWER ARRAY TO SIZE NEEDED:
  mat Response$ = Nul$(1:MRPtr)
  for iiii = 1 to MRPtr
     let Response$(iiii) = MasterResponse$(iiii)
  next iiii
end if
          sub ClearPage_SetToTop ! local subsub
    ! Erase Text (only) Area:
    set color UBackHue
    box area UL,UR,MidY,EWT
    box area LL,LR,EWB,MidY
              if UWindowFrame => 0 then
       set color UWindowFrame
       box lines WL,WR,WB,WT
    end if
              let Y  = TMar
    let X1 = UL + MarginTrim
    let X2 = UR - MarginTrim
    let SpCh = SpanCharsFast(X1,X2,ChW)
    let BottomIsSet = 0
    set color UTextHue
end sub
          sub SetBottomOfPage ! local subsub
    let X1 = LL + MarginTrim
    let X2 = LR - MarginTrim
    let SpCh = SpanCharsFast(X1,X2,ChW)
    let BottomIsSet = 1
end sub
          sub GetUserResponse(p$) ! local subsub
    if p$[1:4] = "SHOW" then
       let p$[1:4] = ""
       when error in
         let test = val(p$)
         if test => LBound(Brush$) and
                    test <= UBound(Brush$) then
            let ANIMPtrs(-10) = test
         end if
        call PollANIMs(Brush$,ImX,ImY,ANIMPtrs,Ignore)
       use
       end when
       exit sub
    end if

    if MRPtr => 30 then exit sub
    let InpLimit = SpanCharsFast(LL,LR,ChW) -2
              let ttt = pos(p$,"-")
    if  ttt > 0 then
         when error in
            let InpLimit = val(p$[1:ttt-1])
            let p$[1:ttt] = ""
         use
            let InpLimit = Maxnum
         end when
    end if
              if p$[1:1] = "0" then
       ! alt-x means fetch XY coords & tell frame#
       let p$[1:1] = ""
       let DoGetXY = 1
    else
       let DoGetXY = 0
    end if
              let QBot = WB +ChH*.1
    let QTop = WB + ChH*3
    box keep LL,LR,QBot, QTop in QueryArea$
              set color UBackHue
    box area LL, LR, QBot, QTop
              set color UWindowFrame
    box lines LL, LR, QBot, QTop
              set color UTextHue
    plot text, at LL +ChW, QBot + (ChH * 1.7) : p$
              let MRPtr = MRPtr +1
    call ABrushCRMouseGraph(LL +ChW, QBot + (ChH * 0.6),
         MasterResponse$(MRPtr),ChH, "_", UWindowFrame,
          InpLimit, Mykk,MyXX,MyYY)
          !-------------------------"
    ! Return X & Y as char from left and line from top  "
    !      (allowing for leading and margins).          "
    !-------------------------"
    let MyXX = Int( ((MyXX -WL)/ChW) -(Margins -1))
    let MyYY = Int( (abs(WT -MyYY) +
                  abs(LineHt)) / abs(LineHt))
              if DoGetXY = 1 then
      let MasterResponse$(MRPtr)[Maxnum:0] = "\" &
          Str$(MyXX) & "\"  &  Str$(MyYY)  & "\" &
          Str$(ANIMPtrs(-10))
    end if
    box show QueryArea$ at LL,QBot
    let QueryArea$ = ""
 end sub
end sub
```

Now we have assumed that the called subs can handle all the oddities of the many kinds of image formats available on the Amiga in all resolutions. The structure of intelligent or smart images is a topic in itself. Digest the above stuff first and we will show how easy it is to handle these image problems next time. Clue: How to make any image smart.

For future articles would you like me to show you how to

1. do CAD stuff without the need for environmental XYZ axes? (Wire frames, rotations, and function oriented object manipulation). Oh, and do it without any matrix math. You'll actually be able to follow it.
2. do dotted and text labeled multicolored lines and arrowheads that do not distort when rotated and maintain features when scaled?
3. write a simple graphic user text input that can use a seed string and edit like a shell?
4. do pie charts that self label and key with text guaranteed to contrast each pie slice? Easy code.
5. generate true 3-D images that can be viewed with XSpecs and used as normal images (brushes, alias get & put stuff)?
6. show you a fast and simple linear phase filter that won't clobber data with power loss or shift and can compensate for sampling rate? (make jittery lines smooth and pentagons into circles)
7. do rubber band boxes, circles, ellipses and ghost line equivalents with shape and image drag ability?
8. explain byte run 1 with a simple easy to follow demo?
9. show how to write IFF and read IFF from within basic?
10. show methods of painting, really painting, within DCTV.

Files:
The following compiled libraries are used
graphics*, intuition*, exec*, diskfont*, hex*, amiga*, Font_Lib*, ScreenModeLib.OBJ, which together take up 143K or 16% of one floppy.

Most of these library calls come from the libs themselves. A program call to only a single library call might reference, indirectly, 4 or 5 of these more basic libraries. Most of the above are merely the True BASIC conversions of the familiar .fd files. The Font_Lib* is written by Paul Castonguay and minimally revised for error handling and format compatibility with the redirection library assignments by Roy Nuzzo. ScreenModeLib is by Roy M. Nuzzo.

Please write to:
Roy M. Nuzzo
c/o AC's TECH
P.O. Box 2140
Fall River, MA 02722-2140

John George Kemeny

In Memorium
1926-1992

Some of you may be familiar with the ads in *Amazing Computing* offering True BASIC. This powerful programming language is the creation of John George Kemeny and Tom Kurt, the developers of BASIC, which as we all know is central to microcomputers and has been since 1964. Without it, the personal computer would not be the consumer product so much in evidence today. Users can program their own routines without the need to distinguish a microchip from a microscope, a ram from RAM.

What is more astounding is the "other" background of John George Kemeny. It's as though being the co-creator of BASIC was not enough distinction in one's lifetime. John Kemeny was one of those individuals who never stop achieving.

John Kemeny came to this country in 1940 from his native Budapest, Hungary, where he had been born in 1926. Not knowing a word of English when he first arrived, John Kemeny nevertheless graduated from the top of his class at George Wasington High School in New York City. At Princeton University he completed his undergraduate work in three years, having taken a year off to work as a research assistant on The Manhattan Project at Los Alamos, New Mexico.

Upon graduation, Kemeny became mathematical assistant to Albert Einstein, working with him on the Unified Field Theory at Princeton's Institute for Advanced Learning. At the age of 23 he received his Ph. D. in mathematics.

Continuing in the tradition of the Ivy League, Kemeny joined the faculty at Dartmouth College in Hanover, NH, as a mathematics instructor. At age 27 he became a full professor, and in two years assumed the chairmanship of Dartmouth's Mathematics Department.
He so loved teaching that when the trustees at Dartmouth offered him the presidency, he negotiated an arrangement with them to be allowed to teach a couple of classes each term.

Only two months into his college presidency, the social unrest brought about by the Vietnam conflict swept college campuses. During the turmoil of the Kent State incident, Kemeny decided to cancel classes and lead his students in a week of mourning and soul searching. He successfully diffused tensions on campus, giving his students a desperately needed release from the throes of the Kent State tragedy and controversy embroiling the nation.

Kemeny vigorously recruited minorities at Princeton, in particular Native Americans. During the summer 1972 session he successfully integrated women into a student body that had been an all-male bastion since 1769.

In 1979 President Jimmy Carter requested that he chair the presidential commission investigating the Three Mile Island incident, the first U.S. nuclear power plant disaster. Kemeny helped draft the report that concluded that human error and a lack of proper controls lead to the nuclear accident. The report criticized the nuclear industry, citing its ineffectual policies and procedures.

His experience with the Three Mile Island investigation led him to call for a change in term limits of elected officials, and for a strong partnership between government and academia on scientific questions affecting the national welfare.

Dr. John George Kemeny died of a heart attack on December 26, 1992, having served his fellow man as an inventor, teacher, philosopher, crusader, and innovator. During his lifetime, he had authored 13 books on wide-ranging subjects. To be known as the co-creator of BASIC would have been luminance enough in anyone's career.

He participated widely in the incidents and ideas that have shaped the nation and the world as we know it. He drew on his intelligence, his wisdom, and his perseverance to fulfill his desire to serve his fellow man to make a difference in the human condition. He himself is a model for us all, and that is to become his most enduring legacy.

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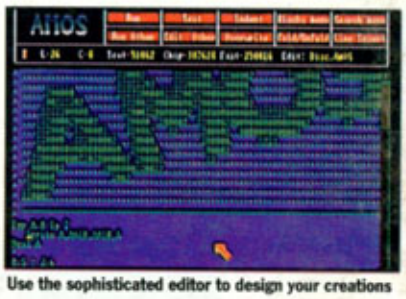

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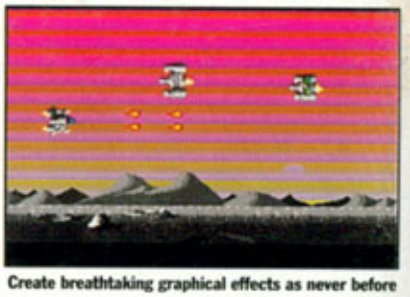
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